

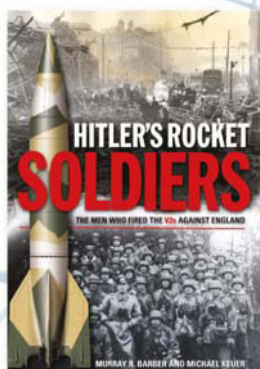
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The Avro Canada Arrow: outrageous fortune?



issue no **3**



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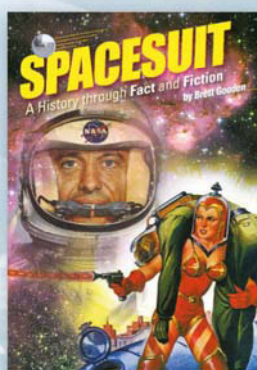
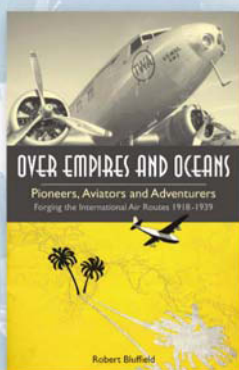
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The modern journal of classic aeroplanes and the history of flying

Editor's Letter

A VERY WARM welcome to the third issue of *TAH*. It's hard to know quite where to start when talking about this one, which, for me, represents the best yet. Why? Allow me to offer a few persuasive reasons.

Using material that has not seen the light of day for the best part of a century, Philip Jarrett offers fresh insight into the development of the Royal Aircraft Factory's innovative "scout" series that would culminate in the superb S.E.5; while Brett Gooden relates the considerable challenges facing the NASA team tasked with keeping astronauts alive in the most hostile environment imaginable. From stick and string to space travel, both show humanity's desire to push ever upwards. On a darker note, Jim Winchester probes the tragic loss of a US Navy pilot and a live thermonuclear weapon at sea in 1965, an episode kept quiet for more than 15 years. Cover-up, or merely cock-up?

With the justifiably much-(re)told Dambusters story being everywhere during this 70th anniversary year, we've decided to take a look at a far less well-known, yet closely-related, episode, in which the stillness of a Scottish loch was shattered by the roar of Merlins and the thump of a mysterious bouncing secret weapon.

So — the best yet? Let me know what *you* think!

FRONT COVER A captivating artwork of two Avro Canada Arrows performing an air combat patrol over the Canadian tundra, created by **ERIK SIMONSEN** for his new book *Project Terminated*, an exclusive extract of which begins on page 26.

BACK COVER MAIN A Seattle Helicopter Airways Cessna Skyhook alights on a rooftop at the World's Fair in 1962. Photo by **JIM LARSEN**.
TOP LEFT The Royal Aircraft Factory's sleek and innovative S.E.2.
TOP RIGHT The sole P-38 Lightning to see civil service in Argentina.

The Cody Statue Project

FOLLOWING THE SUCCESSFUL creation in 2008 of a full-size replica of S.F. Cody's British Army Aeroplane No 1, the first aeroplane to make a powered, controlled, sustained flight in Great Britain in October 1908, the Farnborough Air Sciences Trust (FAST), in conjunction with Rushmoor Borough Council, Hampshire County Council and Rushmoor Rotary Club, is planning to commemorate in August 2013 the death of this pioneer aviator, who perished when his aeroplane broke up in the air, close to Ball Hill, near Farnborough. The centenary of this tragic event will be marked by the unveiling of a life-size bronze statue of Cody, in a prominent position by Farnborough Road, close to both the former South Gate entrance to the Royal Aircraft Establishment and the original position of the famous Cody's Tree, and beside the FAST Museum. The statue has already been commissioned from well-known sculptor Vivien Mallock.

FAST is now seeking donations towards the considerable cost of this statue and the works surrounding it. You can play your part in helping to commemorate this aeronautical pioneer and hero by sending a cheque to The FAST Cody Statue Project or by purchasing a commemorative brick, which will be laid in the paved area surrounding the statue. It is intended to engrave these with the names of individuals and the names of company sponsors. So, if you would like to associate your own name, or that of a relative or friend, permanently with Farnborough's unique aviation history, contact FAST at the telephone number in the panel below, or online.



TOP LEFT Sculptor Vivien Mallock's clay maquette of the statue. LEFT "Cody's Tree", a famous Farnborough landmark. BACKGROUND An artist's impression of the finished statue adjacent to the FAST Museum.

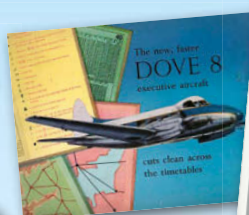
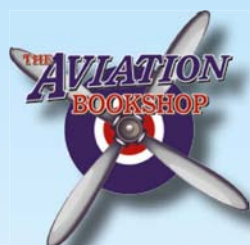
Farnborough Air Sciences Trust, Trenchard House, 85 Farnborough Road, Farnborough, GU14 6TF. Tel 01252 375050 (office manned Sat/Tue/Thur). Websites: www.airsciences.org.uk, www.codystatue.org.uk, www.sfcody.org.uk

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AIR

correspondence

Letters to The Editor

Mistel postscript

SIR — I found Issue No 2 of *TAH* very interesting. It was well-balanced, with a lot of original material to read.

Did you know that Werner Baumbach (*Kommando* of KG 200 when it was operating Mistel “piggyback” bombers — see *Into the Dragon’s Lair, TAH2*) died in a flying accident in Argentina? Ironically, he was a passenger in Fuerza Aérea Argentina (FAéA) Avro Lancaster B-036.

He was one of the many former Luftwaffe crews who came to Argentina after the war: in the spring of 1948, with Allied permission, he emigrated here with his wife and son, and became technical adviser to *Dirección General de*

Fabricaciones Militares (DGFM).

Baumbach joined the *Grupo Henrici*. Led by the Henrici and Mandel brothers, it was responsible for the development of the PAT-1 (*Proyectil Argentino Teledirigido*). This programme, conducted between 1951 and 1953, was based on the Henschel Hs 293 anti-ship guided missile.

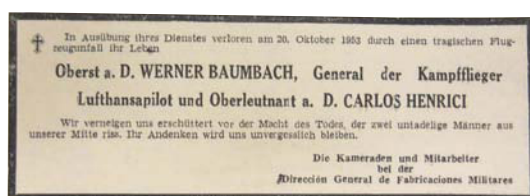
President Perón showed great interest in this project when he visited DGFM’s facilities.

By 1953 work on the PAT-1 was well under way and an aircraft was needed to carry the projectile for airborne test. Initial tests were flown using C-47 T-51, but the DGFM had recognised the operational limitations of this aircraft and began looking for a replacement. By that time, the only

J.C. CICALESI IMAGES (EXCEPT FUNERAL NOTICE)



ABOVE Three members of *Grupo Henrici* in front of Lancaster B-036. **Left to right:** Alfred Lieberwirth, Dr Groth, unknown. **ABOVE RIGHT** The PAT-1 missile. **RIGHT** Lancaster B.I B-036 being recovered at Rio de la Plata. **FAR RIGHT MIDDLE** Funeral notice published by the *Argentinisches Tageblatt*. **FAR RIGHT BOTTOM** A faded but rare view of B-037, another of the Lancs modified to carry the PAT-1.





Send readers' letters for publication to: Air Correspondence, *The Aviation Historian*, PO Box 962, Horsham RH12 9PP, UK, or (preferably) e-mail them to the Managing Editor at mickoakey@theaviationhistorian.com

aircraft available in the FAéA inventory to carry the PAT-1, at least for test purposes, was the Lancaster, and application had been made to the FAéA in early 1953 for the loan of one aircraft. This was granted and Lancaster B.I B-036 was assigned to DGFM.

On April 22, 1953, Lancaster B-036 was assigned to *Taller Regional Rio IV (TRRIV)*, where it was fitted out with the equipment required to make the aircraft "operational ready". The aircraft spent four months at TRRIV, having service equipment fitted and awaiting allocation.

Following overhaul, engine tests and a test flight, the Lancaster was assigned to *No I Brigada Aérea* on August 11.

On October 20, B-036 took off from Morón on a test flight. Aboard the aircraft was *Capitán* Federico C. Mühlenberg (pilot), Karl Henrici (observer), Werner Baumbach (observer), Alfred Lieberwirth (PAT-1 operator) and non-commissioned officer Ivan Viola (wireless operator). At 1040hr, while flying at 13,000ft over Rio de la Plata, engine No 1 caught fire. *Capitán* Mühlenberg attempted a controlled ditching. The Lancaster appears to have hit the water starboard wing down, spinning the Lancaster with such force that the port wingtip was damaged and the rear fuselage and tail assembly broke off. The aircraft had separated at a construction joint and it was not long before the two pieces settled into the water.

Mühlenberg and Lieberwirth were rescued unscathed by a *Prefectura Naval* boat. Werner Baumbach's body was found three days later, according to the accident report; he had been thrown out of the cockpit and drowned. One week after the accident, the bodies of Henrici and Viola were recovered and buried.

On October 25, Baumbach was buried at the German cemetery in Buenos Aires. Later the remains were sent to Germany and buried at Cloppenburg on February 10, 1954.

After the accident, Lancasters B-037 and B-043 resumed testing. The programme was cancelled in 1956.

Ricardo Lezon *Buenos Aires, Argentina*

Another comic?

SIR — I nearly made a big mistake. When I first heard of the launch of *The Aviation Historian*, my reaction was "Oh Lord, not another aviation comic!"

On reading the highly positive editorial in my *Brooklands Bulletin*, I had a quick change of mind, and sent off my 12-month subscription.

Issue One arrives and my decision is completely vindicated. This is definitely *not* another aviation comic, but a serious publication, with excellent articles, superb photography and graphics. Content is really terrific — and, thank goodness, wide-ranging and well-crafted. Congratulations to you and all the team; I trust you will secure the success you clearly deserve.

Keep up the good work — it is so refreshing.

Tony May *via e-mail*

The art of sarcasm

SIR — Listen chaps. This is how to do an Aviation Magazine properly. Remember:

1. Interesting aviation history only happened in World War Two (Vulcans excepted). Spitfires, Lancasters and Messerschmitts sell magazines. We can't cope with anything obscure.

2. We want lots of colour pictures of warbirds flown by men in baseball caps. Aviation is macho. (And Nazi aviation was the most macho of all, but don't say that using actual words).

3. Remember the Spitfire was the best fighter ever (unless you are going after the American market, in which case substitute "Mustang" in the above sentence).

4. Don't worry about spelling or grammar. The only time I need to spell right is if I'm logging in. (And it's "'planes" not "aeroplanes", unless you're, like, 85.)

5. Forget World War One. The 'planes didn't go very fast. Might as well learn about Ancient Rome.

6. Civil Aviation? Booooring! (Crashes excepted). It's been a pleasure giving advice.

Adrian Roberts *via Facebook*

PS I've also sent an e-mail saying what I really think, which is the opposite of everything above!



AIR *correspondence*

I was on Mount Süphan

SIR — I read with great interest your account of the 1959 Mount Süphan Super Trader crash (*Ill Wind, TAH2*), for I was one of the RAF Mountain Rescue team tasked with destroying the secret cargo.

There were six of us in the party to the summit: Murphy, Hercod, Hutchison, Whiting, Henson and Fiddes.

George Murphy and I blew up the cargo. And quite a cargo it was! The Officer in Charge had given us his camera so that we could take photographs of each item before we destroyed them. It was my job to take the pictures, and towards the end (it took all day) I was getting tired with all the exertion at 14,000ft. I took a photograph and left the camera on top of a packing case close by, and ran for cover. We were running out of fuze cord and had to use shorter and shorter pieces, hence the haste to get away with all speed.

After the detonation, the camera survived but the film inside it didn't. Flight Lieutenant Robertson (our leader) was pretty ticked off about that.

While Murphy and I destroyed the cargo,

the others guarded the crash site for us. Guard duty at 14,000ft in freezing weather was not a pleasant experience.

Reflecting back to that event, the one thing that sticks out in my mind is that in my entire lifetime I cannot recall a finer example of teamwork than in the three days and two nights we spent on that mountain. Everyone performed to the highest level and beyond the regular call of duty. I was a reluctant RAF National Serviceman when I was called up to serve my two years, but after this experience I could see the point of all of the discipline and training we had been subjected to. It all paid off in those three days and we all lived to remember the experience.

Gordon Hercod *New Hampshire, USA, via e-mail*

Resistance is futile

SIR — In checking your website, I couldn't resist, so subscribed.

Steve Remington *California, USA, via e-mail*

That rings a bell . . .

SIR — On receiving Issues 1 and 2 of *The Aviation Historian*, my first impressions are:

1. I very much like the unusual format. Very

One Furious Summer postscript: a Pakistan Fury presentation ceremony



HAVING READ the late Peter W. Brooks's article in *TAH1* about ferry-flying a Hawker Fury from the UK to Pakistan in 1949, reader David Halford from Ringwood, Hants, sent us these photographs. Acquired from a Pakistani friend, they are taken from an album presented by the Royal Pakistan Air Force (RPAF) to The Wali of Swat, showing the induction ceremony of a Hawker Fury donated by the State of Swat to the Government of Pakistan. The pictures show **LEFT** Fury K857 Jahanzeb (the same one shown at Langley on page 78 of *TAH1*); **BELOW** The scene at Karachi's Drigh Road aerodrome; **OPPOSITE** Air Vice-Marshal R.L.R. "Batchy" Atcherley CBE AFC, the Air Commander of the Royal Pakistan Air Force, and Begum Liaquat Ali Khan, wife of Pakistan's first Prime Minister, naming K857; and their speeches.



distinctive size, which will certainly stand out from the crowd.

2. Very good quality paper, which is important, as *Aeroplane* found out recently.

3. Very good graphic design. Distinctive and pleasantly subtle. Glad you haven't gone the route of *Car* and *Top Gear*. That suits their style, but not something that is trying to be a serious historical journal. Makes you immediately feel that you want to keep them on your bookshelf as a collection. That will drive the wife mad, of course.

Some special points of particular interest to me are:

I attended the 1950 RAF show at Farnborough and well remember the "German" Spitfires.

I worked with Douglas DC-3s at Croydon with Transair and enjoyed your TWA DC-3 shot at Burbank as I worked there in the 1950s and '60s for Flying Tigers and Pacific Southwest Airlines.

The U-2s were built at Burbank and I well remember seeing them take off on test flights even before we knew what they were.

Clark Gable made his last movie *The Misfits* right here in Reno.

I well remember seeing Robinson Redwings

at Croydon during the 1950s.

We, of course, have quite a few (Sea) Furies flying here every year at the National Air Races.

Plus the 1952 Chevrolet in the Pakistan picture is identical to my first and second cars. New York and Tokyo respectively.

I worked with Douglas DC-4s in the Philippines with American International Airways and with KLM L-749 Connies on charter to Air Ceylon at Heathrow.

I flew on a Cathay Pacific Electra from Hong Kong to Manila.

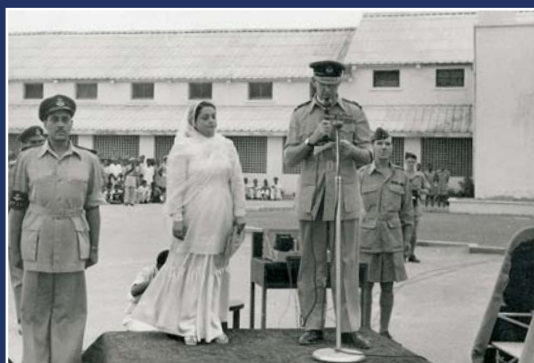
The president of our aviation lunch club here in Reno is an ex-Air America pilot who spent many years in Laos flying Turbo Porters. Prior to that he flew Caribous in the US Army in Vietnam.

I worked with Convair 340s at Heathrow with KLM in 1956.

So, you can see that I relate personally to almost every article in your first two issues!

Congratulations on a fine effort. I am looking forward very much to future editions of *The Aviation Historian*. It must be quite a gamble to launch something different like this. I am sure it will catch on.

John A. Townes Sparks, Nevada, USA



**AIR COMMANDER, ROYAL PAKISTAN AIR FORCE, REQUESTING
BEGUM LIAQUAT ALI KHAN TO PERFORM THE CEREMONY.**

"YOUR EXCELLENCIES, LADIES AND GENTLEMEN,
MAY I SAY AT ONCE HOW PLEASED AND PROUD WE ARE TO WELCOME HERE THIS MORNING BEGUM LIAQUAT ALI KHAN—WHO HAS GRACIOUSLY CONSENTED TO PERFORM THE NAMING CEREMONY OF THIS FURY. MAY I TAKE THIS OPPORTUNITY TO SAY HOW VERY MUCH WE WELCOME ALSO YOUR KINDLY PRESENCE HERE THIS MORNING. THE FIGHTER, WHICH THE BEGUM IS SHORTLY TO CHRISTEN, IS THE FIRST OF A SERIES OF HAWKER FURYS, WHICH ARE TO REPLACE THIS YEAR THE PRESENT HAWKER TEMPESTS. FOR OBVIOUS REASONS I CANNOT DISCLOSE THEIR EXACT PERFORMANCE, BUT I CAN SAY THEY ARE A GREAT IMPROVEMENT ON THEIR PREDECESSORS AND THIS FIRST ONE FLEW FROM LONDON TO KARACHI IN 15 HOURS, BREAKING THE EXISTING RECORD. THE FIRST FURY HAS BEEN MOST GENEROUSLY PRESENTED TO PAKISTAN BY THE RULER OF SWAT WHO WAS ASKED BY MA. LIAQUAT ALI KHAN TO PERFORM THIS CEREMONY AND TO ELECT THE NAME. DISTANCE HAS PREVENTED THE RULER COMING TO KARACHI BUT HE HAS CHOSEN THE NAME 'JAHANZEB' AFTER HIS SON AND ASKED THE BEGUM IF SHE WOULD KINDLY PERFORM THE NAMING CEREMONY. I NOW HAVE GREAT PLEASURE IN ASKING THE BEGUM TO CARRY OUT THIS CEREMONY."



**BEGUM LIAQUAT ALI KHAN GIVING A SPEECH BEFORE
PERFORMING THE NAMING CEREMONY.**

"AIR VICE-MARSHAL ATCHERLEY, OFFICERS OF THE ROYAL PAKISTAN AIR FORCE, LADIES AND GENTLEMEN. IT IS A GREAT PLEASURE FOR ME TO COME HERE THIS MORNING AND PARTICIPATE IN THE FIRST FORMAL NAMING CEREMONY OF THE HAWKER FURY AIRCRAFT WHICH HAS COME TO PAKISTAN. THE AIRCRAFT HAS BEEN GIVEN TO PAKISTAN BY THE RULER OF SWAT AND I AM SURE THAT EVERY ONE IN PAKISTAN WILL BE MOST GRATEFUL TO HIM FOR THIS GENEROUS GIFT OF HIS. THE AIRCRAFT HAS ALREADY MADE HISTORY BY FLYING FROM LONDON TO KARACHI IN A RECORD TIME OF 15 HOURS. THE TRIBUTE GOES TO THE FIRMNESS OF PLANE AND SKILL OF THE PILOT. THE RULER OF SWAT HAS REQUESTED THAT THIS PLANE SHOULD BE NAMED JAHANZEB AFTER HIS SON AND HEIR-APPARENT AND I THINK THE NAME IS MOST APPROPRIATE. I AM SURE THAT THIS AIRCRAFT, ALONG WITH ALL THE OTHER MACHINES THAT ARE IN THE SERVICE OF R. P. A. F., WILL NEVER BE USED AS AN INSTRUMENT OF AGGRESSION AGAINST ANY ONE BUT, WILL ALWAYS BE READY TO PARTICIPATE IN THE PROTECTION AND DEFENCE OF PAKISTAN. I WISH THE AIRCRAFT MANY HAPPY LANDINGS AND BRIGHT AND USEFUL CAREER. I AM VERY HAPPY TO NAME IT JAHANZEB WHICH MEANS WORLD DECORATOR."



A question of perspective

SIR — Loved the first issue: full of new snippets and different takes on some stuff we've heard vaguely about somewhere. Some really great picture finds too. Looking forward to future issues so I can further add to my store of esoteric knowledge (or useless information, depending on your perspective). Great job guys, keep it up.

Alan Hall *via Facebook*

The view from the ground

SIR — Just been perusing *TAH* and it's a promising start. I like the article on the Mercury — could be the start of a series on the famous (and not so famous) aero engines. I like the nuts and bolts side of things and a series like this with manufacturers' drawings similar to those of the Mercury would appeal to modellers as well as historians — never a bad thing to have a broad-based readership.

One item was of personal interest to me: the Calcutta article (*To Belfast via Calcutta, TAH1*). That photograph at the bottom of page 119 was taken directly over Harland & Wolff's shipyard and, more precisely, the main gantry where the *Titanic* and *Olympic* were built. The large structure with the crane jib over its centre rose above the two parallel slipways, the *Olympic* being built on the near side and the *Titanic* on the far side, flanking the River Lagan. That gantry was higher than it looked; I know because I climbed to the top of it when I worked as a draughtsman in H & W, although it was getting a bit dilapidated, with steps rusting away, etc.

I started my working career there in the late 1950s and you can just see the corner of the four-storey block, housing the drawing offices, in the bottom left of the photograph, with the

light-coloured flat-topped roof over the sandstone block. The gantries were demolished, along with every other building in the picture apart from the drawing offices, a long time ago and the whole place looks like a bomb site now. Sad to see what was once a busy shipyard reduced to a wasteland — and the part you can see was just a tiny fraction of the area taken up by the shipyard.

I have attached a view of *Titanic* on the left and *Olympic* on the slipways just before the latter was launched. You can now see the height from ground level, and, if you were to move a few feet to the right of the camera position, you would see the gantries as I saw them every day from the drawing office windows.

Iain Wyllie *Crossgar, Co Down, Northern Ireland*

Hitting the spot

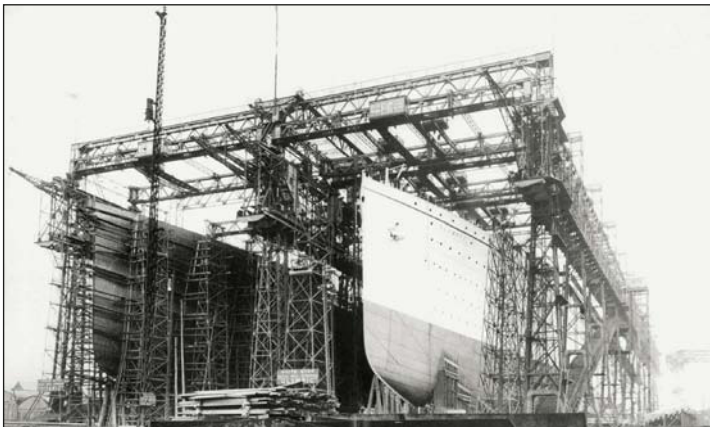
SIR — I thought your first edition was very good indeed, and appreciate how much work you must have put in to reach this standard. The "journal" style presentation was excellent and gives the publication a more professional, workmanlike appearance. I particularly liked the articles on the Bristol engine, the Finnish war, the RAF "Furrow" expedition, *Out of the Blue* and the Calcutta to Belfast. A short résumé on the author would have been interesting, as I always find personal background to be fascinating.

Nigel Wilson *via e-mail*

Eureka!

SIR — The journal is a great success; I am enjoying every article. Well done to you and your team. I hope we all have many more issues to enjoy while soaking in the bath.

Jon Budd *via e-mail*



LEFT Ill-fated ocean liner RMS *Titanic* and its sister ship RMS *Olympic* in the Harland & Wolff shipyard gantry in which they were built, shortly before the latter's launch in October 1910. The gantry is the same one shown in the photograph ABOVE, which we first published in our *To Belfast via Calcutta* article in *TAH1* — see Iain Wyllie's letter on this page.

VIA GUY WARNER



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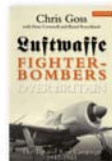
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There I was...

Short stories from the sharp end

In July 1998 legendary airshow pilot and former Red Arrows leader Ray Hanna celebrated the 50th anniversary of his first solo by reuniting with the Folland Gnat, the type in which he established his reputation as one of the greatest formation aerobatic pilots of all time. RICHARD PAVER recalls being in the right place in the right time to capture a unique record of a historic occasion



BACK IN THE summer of 1998 the Duxford-based Old Flying Machine Company (OFMC) decided to celebrate the 50th anniversary of Ray Hanna's first solo flight by setting up a special sortie for Ray in Tim Manna's Folland Gnat T.1 G-BVPP/XR993. The occasion was marked on July 7, 1998, at Cranfield, where Ray took the controls for his first Gnat sortie in more than 28 years. As Ray was obviously not current on the diminutive jet trainer he was joined on the sortie by Air Vice-Marshal B.L. "Boz" Robinson, who flew as check pilot in the Gnat's rear seat. I was afforded the opportunity of a lifetime when Ray's son Mark asked me to accompany him in the OFMC's Aero Vodochody L-39 Albatros, G-OTAF, in order to shoot some air-to-air photographs to record the occasion.

The world's most famous father-and-son airshow pilot combination lined up in two jets on the Cranfield runway and took off in close formation with yours truly very much at the sharp end, tightly strapped into the rear seat of the L-39 and desperate to make sure that I wasn't the one to mess up! To say the adrenaline was flowing was an understatement, and once my photography was complete Mark took me for some "gentle aeros" in the Cranfield overhead. On landing I decided that Mark's definition of "gentle" was somewhat different from my own!

Little did I realise at the time that I had been privileged to fly with two now much-missed legends of the air display world. Mark was to die in an accident just over a year later and Ray died at home in 2005; these photographs are now a unique record of a very historic sortie.



MAIN PICTURE A characteristically superb portrait by the author of Folland Gnat T.1 G-BVPP/XR993 with Ray Hanna at the controls and Boz Robinson in the back seat during the photographic sortie on July 7, 1998.

RIGHT The dream team — from left to right: Mark Hanna, AVM Boz Robinson and Ray Hanna beside the Gnat in July 1998. The consummate performer, Ray joined the Red Arrows in 1965 and served as the team's leader during 1966–70, during which time he was instrumental in establishing the Gnat as a firm favourite with the public.



A magnificent Hawker photograph of the very last batch of Hurricanes being produced at the company's factory at Langley in the summer of 1944. The final example of 14,533 Hurricanes built, PZ865, was named The Last of the Many and after a long and varied career is still operated today, as part of the RAF's Battle of Britain Memorial Flight.

ALL IMAGES THE AVIATION HISTORIAN ARCHIVE





I BUILT THE LAST OF THE MANY

In early 1940 Lancashire lad **HERBERT MORRIS** decided to head south to look for employment. With a brother-in-law in Slough his first port of call was Kingston-based Hawker Aircraft, for which he worked on Hurricanes, Typhoons and Tempests for the next five years. Three decades later Herbert wrote a charming letter to Hawker Siddeley Aviation at Kingston, in which he recalled what wartime life was like at Hawker's Langley factory

WE PRESENT HERE in its entirety the contents of the handwritten memoir sent by wartime Hawker employee Herbert Morris to Hawker Siddeley's public relations department at Kingston in June 1974, in which he wanted, in his own words, to "look back to those great days at Hawker and re-live those happy times . . ."

LANCASHIRE IN 1939 was still suffering from the black depression years of the early '30s and, having been unemployed for months, I decided to move south to look for work. I had a brother-in-law who lived in Slough and who then worked for Hawker, and he paved the way for me to have an interview for a job. At that time Lancashire's cotton trade was the "Cinderella" of industry and to be a weaver was by no means the best recommendation for any other work.

So early in 1940, with the war still in its infancy, I went to Slough and had an interview at Hawker Aircraft Ltd, which was looking for fresh labour in view of the increased demand for aircraft. I was accepted as a trainee and that was the best break I had ever had; from then onwards I never looked back or ever had any regrets.

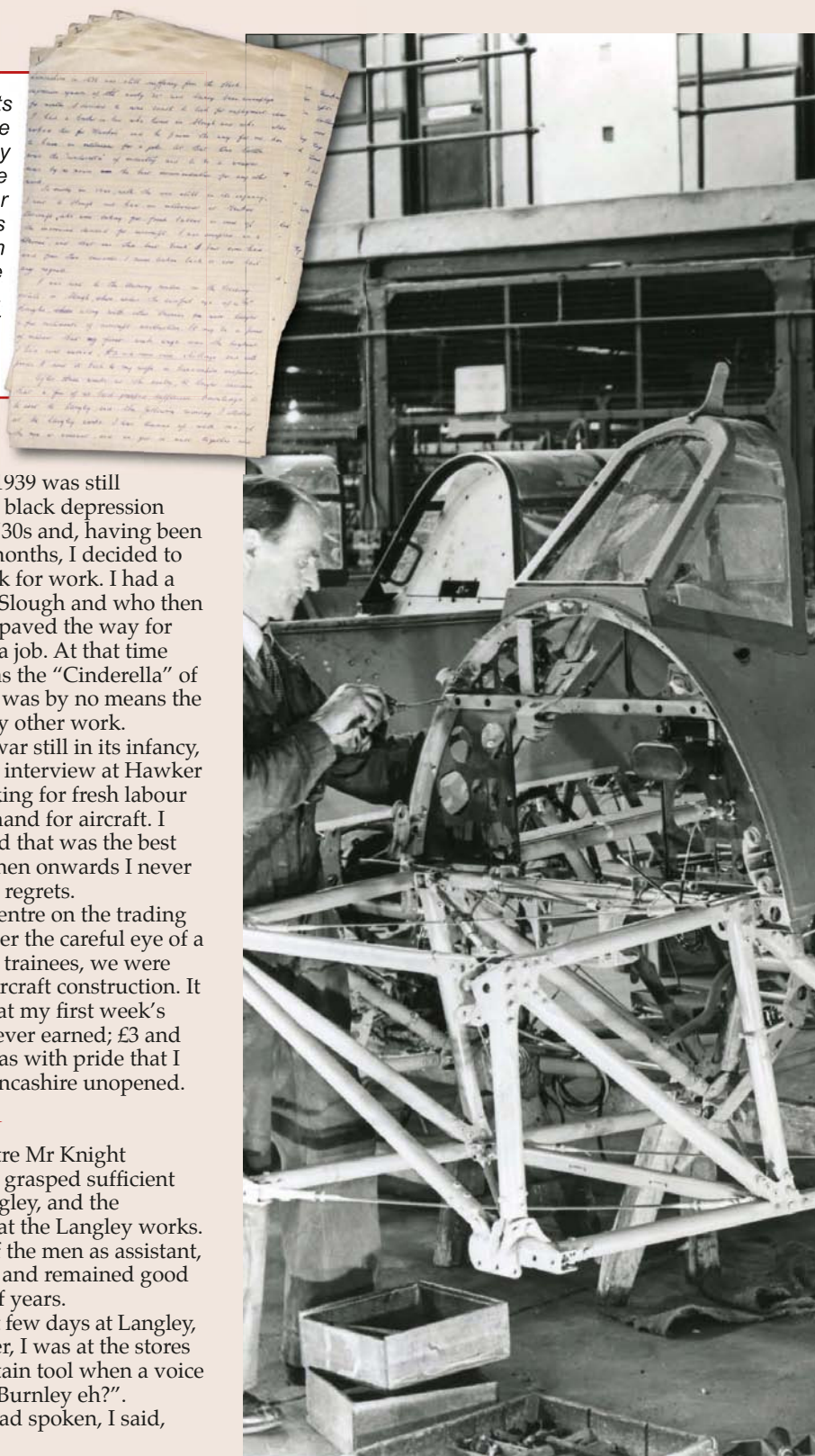
I was sent to the training centre on the trading estate in Slough, where, under the careful eye of a Mr Knight, along with other trainees, we were taught a few rudiments of aircraft construction. It may be a point of interest that my first week's wage was the highest I had ever earned; £3 and some odd shillings, and it was with pride that I sent it back to my wife in Lancashire unopened.

OFF TO LANGLEY

After three weeks at the centre Mr Knight decided that a few of us had grasped sufficient knowledge to be sent to Langley, and the following Monday I started at the Langley works. I was teamed up with one of the men as assistant, and we got on well together and remained good friends for a good number of years.

I remember during the first few days at Langley, feeling very much a foreigner, I was at the stores window and asked for a certain tool when a voice at my shoulder said, "From Burnley eh?"

Turning to the chap who had spoken, I said, "No, Blackburn".





Hawker engineers at Langley work on Hurricane IIC PZ865 in July 1944, its newly-minted name, The Last of the Many, clearly visible on the panel beneath the cockpit.



ABOVE A group photograph of "A" Company of the 13th Buckinghamshire Battalion of the Home Guard, made up entirely of Hawker's Langley employees. On the original photograph sent to Hawker by Herbert a small "x" has been added above the head of the bespectacled member in the back row, as enlarged in the inset to the left, which is probably Herbert himself, although this is unconfirmed.

"I'm from Bolton, but I wasn't far out, was I?", he said, and from then on I ceased to feel like a foreigner.

The war was "hotting up"; a great number of women were drafted in to work with the men at the works, and practically every chap had a girl assistant. There were girls from every walk of life and dialects from almost every county. Some were very capable and soon became very proficient, and if one got a "good" girl, you hung on to her.

Work increased, hours increased, and as the tempo of the war increased, so did the pace of our production of Hurricanes. Seven days work and the eighth off as a rest day. As the air raids increased and became more frequent we were all issued with tin hats which we put on when the alert sounded, but we carried on working. Direct contact with the coast watch gave us the alert and red lights throughout the works lit up. Then if the works siren sounded we had to go to the nearest shelter immediately until the all-clear.

The factory and airfield were surrounded by a balloon barrage to deter enemy raiders, but I well remember one Sunday afternoon one raider got through and dropped a stick of bombs, partly destroying one of the workshop walls.

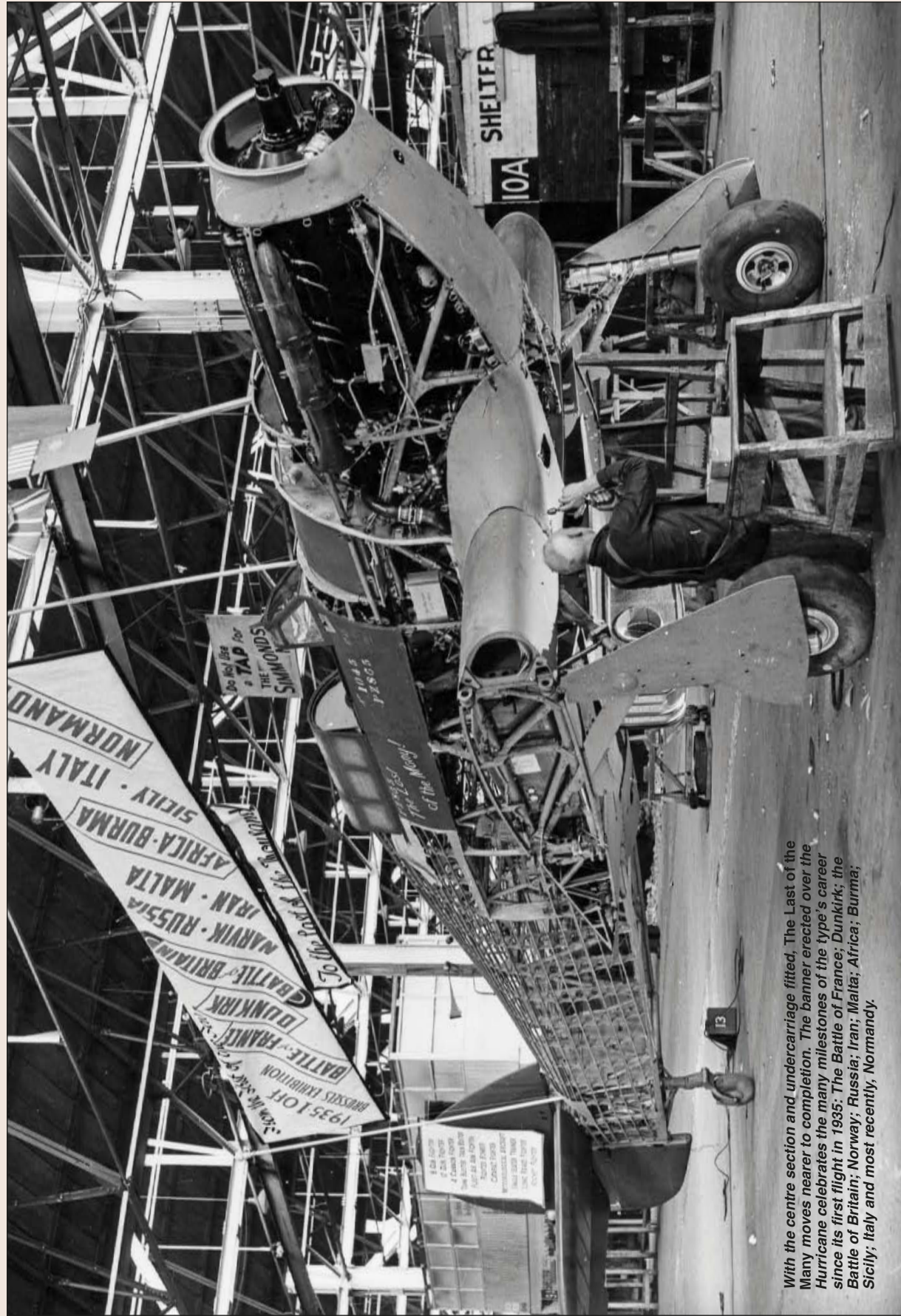
Fortunately no-one was hurt, but we all went home early that day as the damage had upset the power to the works.

DAD'S ARMY

I think it was in 1942 [actually May 1940 — Ed] when the Home Guard was formed and Langley works had its own battalion — 13th Bucks. Captain Bird was seconded from the army to be CO and I was in "A" Company, whose CO was a Major Marsh. A rota put us on guard duty one night each week and when my night came along I went to work in full uniform.

After work I reported to the guard hut for the night. We had to patrol the factory area only, as the RAF patrolled the airfield with very unfriendly dogs, so we never made much contact. We in "Dad's Army" were a motley crowd and, when on parade, must have seemed to anyone with army experience lacking in a great many things. However, all were volunteers and, although we never came to grips with the enemy, we could not have been more willing to have a go. Before we had regular huts fitted with bunks etc, we used to sleep in various parts of the factory and I remember on one occasion sleeping in the boardroom.

Once we visited the shooting range at Bisley,



With the centre section and undercarriage fitted, The Last of the Many moves nearer to completion. The banner erected over the Hurricane celebrates the many milestones of the type's career since its first flight in 1935: The Battle of France; Dunkirk; the Battle of Britain; Norway; Russia; Iran; Malta; Africa; Burma; Sicily; Italy and most recently, Normandy.



ABOVE An aerial view of the Langley works taken during Tempest production. The factory was constructed on the site of Parlaunt Park Farm during 1937–38 as a result of Hawker's urgent need for greater production facilities. **BELOW** Chief test pilot Gp Capt P.W.S. "George" Bulman prepares to fly PZ865 at its "christening" in August 1944.

and on another occasion went to some place for a mock battle using blank ammunition. On the whole I think we did a fair job and can look back after all these years with satisfaction and pride.

"THE LAST OF THE MANY"

I can well recall the occasion when the last Hurricane was built and the scene was set in the flight shed of the christening of *The Last of the Many* [Hurricane IIC PZ865]. This was written on the fuselage and I can still picture the scene. A platform had been erected and draped with bunting and flags and we all got about an hour off from work to go to the christening.

Many VIPs were there and the wife of Sir [Frank] Spencer Spriggs (I think) had the honour to christen the Hurricane *The Last of the Many*. After this it was taken out to the airfield and was flown by Major Bulman who was, I think, a Director of Hawker. Also in the air was an old but still serviceable Hawker Hart. A very memorable occasion.

I remember doing a spell on repairs; damaged Hurricanes used to be brought in from active service to be repaired or scrapped and salvaged for spares. These had bullet and cannon shell holes in them and I once fished a dead seagull from the air intake. Bits of twigs, a part of a telegraph pole, soil and turf were all part of the damage, each 'plane recording in its way a tragic role.

After the war, when the Essential Works Order





ABOVE Shortly after its first flight on July 22, 1944, The Last of the Many was the centrepiece of a ceremony at Langley in which the aircraft was “christened”. A number of speakers took turns to celebrate the achievements of the type, including George Bulman and the General Manager of Rolls-Royce’s aero-engine division, Mr H.J. Swift.




ABOVE Following the speeches at the ceremony PZ865 was prepared for a short flying display in the hands of Bulman. The celebrations continued with displays by several other Hawker types retained by the company, including Tempest V EJ592 (flown by Bill Humble) and Hart II G-ABMR, now on display at RAF Museum Hendon.



ABOVE *The Last of the Many makes its way up Kingston High Street in a photograph taken from the Town Hall during the victory parade on June 8, 1946.*

was lifted, I left Hawker for Langley Alloys and learned another branch of engineering. I stayed for a few years, then went back to Hawker — my first love — for I liked the aircraft industry. Then came a falling-off of work and I became redundant. Some of us were offered work at Kingston, but it was too far for me to travel each day (by this time my son was born and domestic cares were tying).

So I turned down the offer and got a job in Colnbrook, still in engineering. Then events happened in the domestic field and my wife, son and I decided to return to Lancashire where I had an engineering job waiting for me. So here I am back north, now retired as a senior citizen. But I can honestly say my work with Hawker and my years in Buckinghamshire will forever be a happy and pleasant period in my life. Whenever I can, I go to Slough for a holiday with my sister, who still lives there; and when I see the factory at  Langley I can still see many happy memories.

COMING SOON — The Last of the Many:
The Racing Years . . . the blue-and-gold era in which PZ865 became G-AMAU and dazzled the public as a racer and film star

THE LAST OF THE MANY ON PARADE, JUNE 8, 1946

ON JUNE 8, 1946, a victory parade was held in Kingston, Surrey, *The Last of the Many* being one of the main attractions. Having been bought back by Hawker from the Air Ministry in December 1944 for use as a trials aircraft, the Hurricane had its wings removed and it was mounted on a trailer pulled by a Hawker flatbed truck. *The Surrey Comet* of June 12, 1946, reported:

"Soldiers of two wars, men and women of the Home Front and representatives of industry took part in Kingston's Victory Parade on Saturday.

"Crowds lined the route, particularly at the Guildhall, where the Mayor (Mr F.C. Digby) and members and officials of the Corporation took the salute. Industry's part in achieving victory was strikingly typified by tableaux staged on lorries showing employees of Hawker and Leyland Motors clad in overalls and working at their machines. A feature of the procession was a Hawker vehicle carrying the last Hurricane.

"The rain held off as the parade made its way from Portsmouth Road and along Eden Street, Brook Street, Orchard Road, Fairfield South, Hawkes Road and Cambridge Road before finally dispersing in Douglas Road, but a heavy downpour in the afternoon caused some of the day's activities to be transferred indoors."



George Bulman puts PZ865 through its paces for a dazzling sequence of aerial photographs, possibly taken on the occasion of its ceremony in August 1944. It was entirely fitting that Bulman should fly The Last of the Many at the ceremony, having been at the controls of the prototype Hurricane, K5083, for its maiden flight on November 6, 1935.

THE GLIDER WITH BUILT-IN THERMALS . . .

Paris Air Salon, 1951: the flying display opens with a deafening demonstration by a pair of . . . gliders. Although they looked like the humble training sailplanes usually found silently soaring, these were fitted with a battery of bellowing pulsejets. We don ear-defenders to take a look at the Emouchet Escopette

THE OPENING ACT at the 19^{ème} Salon International de l'Aéronautique, held at Le Bourget, Paris, between June 15 and July 1, 1951, was specifically selected to announce the commencement of the flying display in no uncertain terms, the aircraft chosen for the occasion no doubt causing double-takes – and the swift clamping of hands to ears. On the dot of 1500hr a pair of Arsenal SA.104 Emouchet gliders, each fitted with a battery of SNECMA Escopette pulsejets on each wing, thundered into a demonstration routine, leaving little doubt that the afternoon display had well and truly begun.

THE GLIDER

Designed for quantity production under France's wartime Vichy government, the SA.103 Emouchet (Kestrel) primary training glider was constructed by the Arsenal de l'Aéronautique at Châtillon-sous-Bagneux, a suburb of Paris, and made its first flight in 1942. Using the same principles as the ubiquitous Schneider Grunau Baby, the Emouchet was a single-seat open-cockpit glider with a high wing, the latter being attached to a faired pylon and supported by a single steel strut on either side.

The single-spar wings, with a span of 40ft 11in (12.48m), were constructed of wood with a fabric covering and comprised a parallel-chord centre section with tapered outer panels with rounded tips, ailerons being fitted to those outer panels. No flaps or spoilers were fitted to the SA.103, but were added to the later SA.104.

The hexagonal-section fuselage was skinned in plywood, the fabric-covered tail surfaces comprising the tailplane set forward of the fin, which was narrow and fitted with a broad, curved rudder.

The undercarriage was a simple single forward skid and tail bumper, the follow-on SA.104 incorporating a single mainwheel.

THE PULSEJET

Developed by the Société Nationale d'Etudes et de Construction de Moteurs d'Aviation (SNECMA), the Escopette was a pulsejet of the Marconnet type with no inlet valves, in which gas movement is regulated only by varying the dimensions of its duct. In common with all pulsejets, the Escopette produced thrust from extremely few parts. These were: a detector (intake unit comprising a venturi with a bias towards the passage of fluid in one direction only), combustion chamber, main body, tailpipe, recuperator, fuel injector and igniter plug (used only for starting). The controls for the pilot were simple; set the throttle for the pulsejets at the starting position, switch on the ignition and open the fuel cocks. The jets were used for take-off and could be restarted in flight.

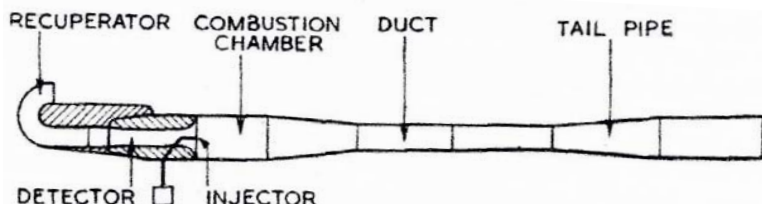
THE SHOW

In the July 6, 1951, issue of *Flight*, its correspondent described the Emouchet duo's ear-splitting display with a mixture of admiration and, ultimately, relief:

"The flying programme officially opened on a note of novelty, for the performers were a pair of Emouchet Escopette gliders powered with pulsejets. Both made an impressive amount of noise (as was expected) and clipped along the enclosures at very low level and at speeds which ranged between 60 and 90 m.p.h. [97-145km/h]. Visually this was an appealing little display, and in a sense one even appreciated it aurally – it was so nice when the noise stopped . . ."



RIGHT A diagram of the very basic elements of the Escopette Marconnet-type pulsejet, first published in the January 25, 1952, issue of *Flight*. To see a pulsejet being bench-run (and get some idea of the somewhat distinctive noise it makes) see The Aviation Historian website (www.theaviationhistorian.com).



ARSENAL SA.104 EMOUCHET ESCOPETTE DATA

Powerplant 4 or 6 x SNECMA Escopette pulsejets of 22lb (10kg) thrust, each with a dry weight of 10lb (4.5kg), running on petrol of any octane value

Dimensions

Span	40ft 11in	(12.48m)
Length	22ft 1in	(6.74m)
Height	6ft 7in	(2.0m)
Wing area	177.6ft ²	(16.5m ²)

Weights

Empty	388lb	(176kg)
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Useful load	597lb	(271kg)
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Performance

Never-exceed speed (V_{ne})	99 m.p.h.	(160km/h)
Rate of sink	165ft/min	(0.84m/sec)
Lift-to-drag ratio	approx 20:1	(maximum)
Wing loading	3.4lb/ft ²	(16.4kg/m ²)



Arsenal SA.104 Emouchet F-WGGH (c/n 224) was one of at least two examples of the training glider fitted with SNECMA Escopette pulsejets. It is seen here with a total of six Escopette units installed, arranged in clusters of three on each wing. The other example, probably F-WGGG (c/n 203), was fitted with a cluster of two on each wing. The Aviation Historian extends thanks to MIKE HOOKS for his help with the preparation of this article.



One of the many endlessly fascinating digital illustrations created by ERIK SIMONSEN for his Cr cy book *Project Terminated: Famous Military Aircraft Cancellations of the Cold War and What Might Have Been*, this shows Avro Canada CF-105 Arrows Nos 213 and 204 climbing in formation with full afterburner high over Canada. Although a formation flight of the two prototypes, 201 and 202, was planned several times, it never actually took place.

PROJECT TERMINATED

*In an exclusive extract from his excellent newly-published book, Project Terminated, **ERIK SIMONSEN** examines the political manoeuvring that ultimately put paid to the development and entry into service of one of the most promising interceptors of the Cold War era — Avro Canada's CF-105 Arrow, a type that, with enough political backing, may well have served with the RAF*



BY LATE 1955 the United States Air Force (USAF) had completed an examination of Canada's ambitious new state-of-the-art interceptor aircraft, the sleek Avro Canada CF-105 Arrow, potentially with a view to adding it to its own inventory. Coincidentally, the British Minister of Supply, Reginald Maudling, visited Canada at this time and his memo to the Ministry of Defence stated how he was "impressed by the Canadian CF-105 which the USAF has just evaluated". It looked as though the potential high-performing interceptor could fit into both the UK's own air defence programme, and possibly that of the US Air Defense Command (ADC).

There seemed to be general agreement that the USAF was impressed with the CF-105, and that a team from Britain should also go to Canada to evaluate it. This was a promising bright spot for the CF-105 programme. The Canadian

government would most likely fully support a foreign customer for the Arrow as insurance in holding down the cost of the type's development programme.

The UK's defence gap

The RAF had projected 1959 to be a critical year for interceptors, when it was believed that the subsonic Gloster Javelin's performance would be inferior against improved versions of the Soviet Myasishchev M-4 *Bison* and Tupolev Tu-16 *Badger* bombers. The Soviets were also developing the supersonic Tu-22 *Blinder*, and predictions were that RAF interceptors would have no chance of engaging supersonic bombers deployed by the early 1960s.

Unless the more advanced proposed Thin Wing Javelin (TWJ) entered service, there would be a gap in the UK's defences until a new fighter was available. The Air Ministry realised that

The Arrow's low-slung nose-high attitude while on the ground giving it the appearance of a tiger on a frayed leash, the prototype, RL201, is seen here at Malton Airport, north-west of Toronto, in 1958.

JAY MILLER COLLECTION VIA AUTHOR





ABOVE *The Arrow prototype makes a pass over Niagara Falls during its test programme. A number of the systems adopted for the aircraft proved to be innovative; the Arrow's 4,000lb/in² hydraulic system, for example, was highly advanced and nothing equivalent to it would be developed until the advent of Rockwell's B-1 bomber in the 1970s.*

cancelling the TWJ would damage the morale of Fighter Command and bring political repercussions, since the development of the aircraft had already been announced in Parliament. In addition, the Ministry concluded that there would not be a first-class fighter design team available to put a capable aircraft into RAF service before 1965 — way beyond a critical point for air defence. On the other hand the Air Ministry was aware of the UK's vulnerability in all-weather air defence after the 1959–60 time period and felt that despite its limitations, the TWJ was the only aircraft available to fill the gap. However, the Minister of Supply requested that the potential of the Avro CF-105 be examined as a possible alternative before a final TWJ decision was made.

The CF-105's speed was expected to vary from Mach 1.91 at 40,000ft (12,192m) to Mach 1.4 at 60,000ft (18,288m). The Arrow would be equipped with eight Hughes Falcon air-to-air missiles with either radar-guided or infrared warheads. If operated by the RAF, the CF-105 should be capable of destroying a bogey flying at Mach 1.3 and 60,000ft at a range of 17½ miles (28km) from the British coastline. Using Sparrow II missiles in a head-on intercept mode, the same category target could be hit at up to 64 miles (103km) from the coastline. Another perk for the

RAF was that Avro Canada claimed that the CF-105 could be built under licence in Britain, and RAF deliveries could commence in 1961. However, in its current configuration, the CF-105 could not meet the RAF's speed and altitude requirements of Mach 2 at 60,000ft and Mach 1.5 at 65,000ft without adding a rocket motor.

The positive news was that the aircraft could be available for service several years before any other interceptor project then undergoing development. In addition, the CF-105 design allowed for propulsion and avionics growth, eventually allowing for higher Mach speeds without the addition of a rocket motor. In contrast, the TWJ was likely to be limited in the growth area. Finally, the CF-105 Fire Control System was a proven system, having operated in the Convair F-102 Delta Dagger.

British evaluation of the Arrow

In 1957 a Joint Air Ministry / Ministry of Supply Evaluation Team from the UK spent nearly four days at Avro, while other members of the team visited the Royal Canadian Air Force (RCAF), Department of Defence Production and the Canadian Defence Research Board. Their studies determined that the CF-105 was ahead of the TWJ, while re-engineering the airframe to British

At the time of the Arrow's development, the UK's interceptor hopes were pinned on the Gloster Javelin, a problematic, if brutally attractive, machine of limited capability. In 1952 a new development of the type, the Javelin TWD (thin-wing development), with a 7.5 per cent thickness/chord wing was proposed. Work was started on the TWD in 1955, but cancelled in July 1956.





ABOVE The author's conceptual view of a pair of RAF Arrows, carrying droptanks, up from RAF Coltishall while serving with No 226 Operational Conversion Unit/No 145 (Shadow) Sqn circa 1968. Had the initial talks undertaken by Great Britain and Canada formulated an agreement, the type may well have been procured for RAF service.

standards and incorporating a British engine would only slightly affect performance. A CF-105 with British Olympus OL7R engines of 17,000lb-thrust each, carrying four Sparrow IIs, would be capable of Mach 1.5 at 50,000ft. From scramble, the CF-105 would take just short of 5min to reach that performance parameter.

The question of availability

The report also contained a rather optimistic availability time-slot of the spring of 1961 for the RAF if the aircraft were manufactured in Canada. Assembly in the UK with a British engine, and retaining the Hughes MX1179 fire-control system, would result in deliveries beginning at the end of 1961. By comparison, the TWJ's system, although in the early stages of development, could become obsolete within a few years. With the modifications of installing the British airborne interception (AI) radar and flight- and fire-control systems, Arrow

deliveries to the RAF would be pushed back to autumn 1962. The British team's report clearly concluded that the CF-105 would have a projected operational speed nearly twice that of the TWJ, and its service ceiling would be considerably higher. In all, the report stated that the CF-105 was unquestionably superior in all respects, and was possibly a generation ahead of the TWJ.

The report also concluded that the predicted series of CF-105 delivery dates to the RAF was favourable enough to justify considering procurement in place of the TWJ. On operational grounds the ideal solution would be to procure the aircraft from Canada; but, unless the UK could obtain it under military aid funding, the cost looked prohibitive. Under a projected order of 100 aircraft from Avro Canada, the cost per unit would be about C\$2.1m. To build the CF-105 under licence in the UK, the unit cost was about \$370,000. Compared to the cost of typical fighter aircraft

Proposed Avro Canada CF-105 Arrow variants

ALTHOUGH THE AVRO Canada team had a winning design, it was continually planning future versions. As most aircraft are introduced into the inventory of various services around the world, the same issues always emerge within a minimal amount of time — upgrades and variants. Although the original CF-105 Arrow 2 more than met the RCAF requirements of an operational radius of 264 miles and a combat speed of Mach 1.5 for 5min, the Avro design team had already initiated studies to improve the Arrow's performance, despite no additional RFI (Request For Information) from the RCAF. These were:

Arrow 2A Increased operational combat radius of 690–748 miles at subsonic speeds; capable of intercepting at Mach 1.5 and operate at altitudes of up to 50,000ft. Internal fuel capacity increased with fuel in the fin.

Arrow 3 Changes to include variable intakes and modifications to the nozzle area to allow increased speeds of up to Mach 2.5. Operating altitude to increase to 68,600ft. Range for defensive intercept sorties to increase to approximately 483 miles for supersonic speeds and 575 miles for high subsonic speeds.

Arrow 3A Increased closing speeds on potential intruders plus a new improved fire-control system. Had the CF-105 gone into production, new flight systems and improved radar capabilities would have been available within a reasonable timeframe.

Stand-off platform With a 6,000lb (2,720kg) payload capability the Arrow would fall into the light bomber category. As new stand-off weapons were being developed the Arrow presented a potentially excellent platform for this type of mission. Range could be increased further with the addition of external droptanks. Because of the undercarriage configuration, wing droptanks would be mounted on hardpoints further outboard on the wing than in standard configurations. Modifications to the weapons bay doors could also allow ventral drop tanks that would be jettisoned before the arming sequence.

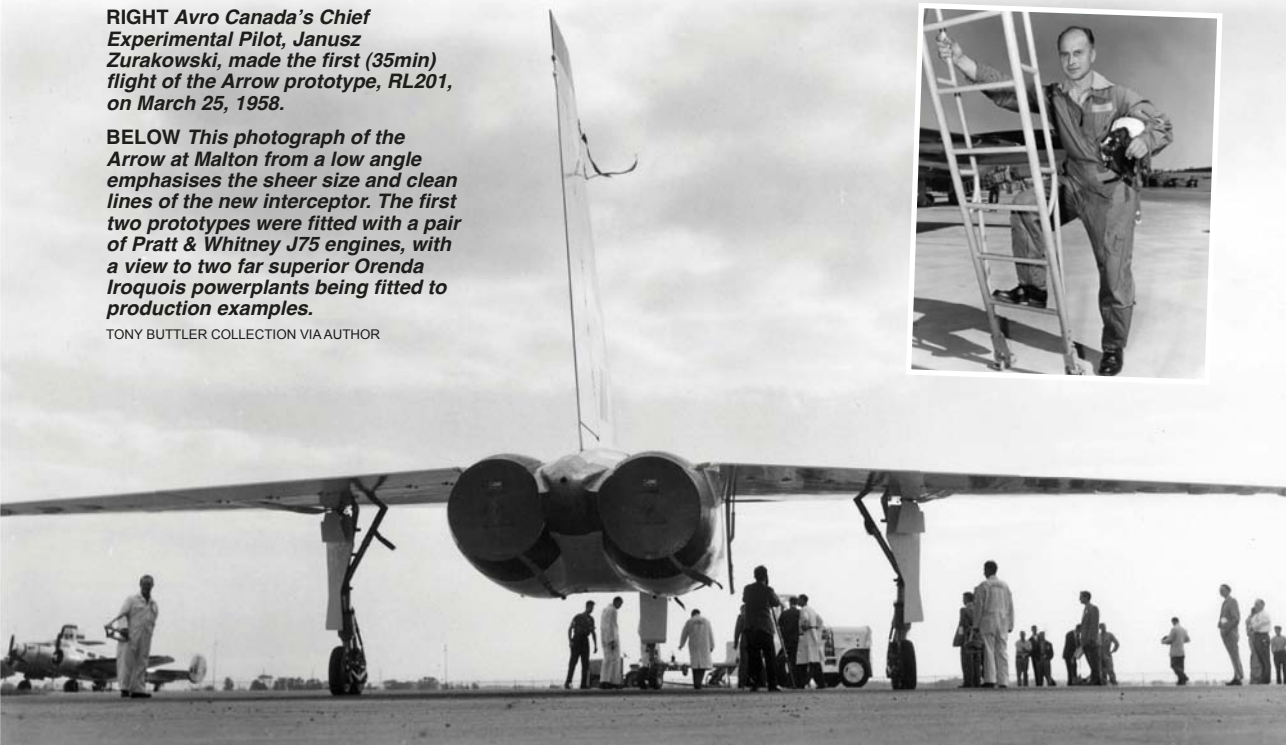
Reconnaissance version Avro Canada engineers studied a reconnaissance variant that would operate at altitudes of up to 90,000ft. Wing area to be increased for additional fuel plus the addition of ramjets for use during the initial leg of the mission was proposed. For increased thrust with the same amount of fuel, High-Energy Fuel (HEF) was considered. Because of handling and operational problems encountered during testing, this fuel type was cancelled on August 10, 1959, as North American was developing the XB-70 Valkyrie programme.

Super Arrow Before the Arrow's cancellation on "Black Friday", Avro Canada's engineers were exploring modifications that could greatly enhance the Arrow way beyond anyone's expectations. With highly modified variable intakes, the Arrow was to be able to reach Mach 3 in increments when required, but not cruise at this speed. The operating altitude would be approximately 68,000ft, with air-to-air missiles with a range of at least 200 miles (320km), and peak attitudes of 80,000ft.

RIGHT Avro Canada's Chief Experimental Pilot, Janusz Zurakowski, made the first (35min) flight of the Arrow prototype, RL201, on March 25, 1958.

BELOW This photograph of the Arrow at Malton from a low angle emphasises the sheer size and clean lines of the new interceptor. The first two prototypes were fitted with a pair of Pratt & Whitney J75 engines, with a view to two far superior Orenda Iroquois powerplants being fitted to production examples.

TONY BUTTLER COLLECTION VIA AUTHOR



In 1956 Boeing B-47 Stratojet 51-2059 was lent to the RCAF for trials at Canadair with the Orenda Iroquois engine, the aircraft being redesignated CL-52. The engine was mounted on the starboard rear fuselage and tested, although its position was far from ideal. After some 35hr of Iroquois test-flying the B-47 was returned to the USA, becoming the only example of the type to see foreign service.

MIKE HOOKS COLLECTION



that would appear just ten years hence, the Arrow unit price would appear to be quite a bargain. Nevertheless, the offer was passed up.

On February 24, 1956, the Deputy Chief of the Air Staff, Air Marshal Sir Thomas Pike, proposed that the Air Council cancel the TWJ and agree to build the CF-105 in the UK with a British engine, but retaining the MX1179 and Sparrow system. But it was the economics and the extent of any likely military aid that would have the biggest influence in any decision to adopt the fighter.

In terms of available capability, the USAF equivalent was the Convair F-102 and possibly the same company's in-development F-106 Delta Dart. With far greater performance was the Long Range Interceptor Experimental (LRIX), which would become the North American F-108 Rapier. However, during the next Air Council meeting, on April 12, 1956, the indication was that the CF-105 would not be procured. Most concluded that cost was the primary reason for its rejection.

Final days and "Black Friday"

Overall, the programme test pilots highly praised the Arrow's fly-by-wire system, which for 1958 was advanced. Another milestone for the aircraft was reached when it proved able to pull at least 2g in a turn at 50,000ft without losing speed or altitude. This was achieved using temporary lower-thrust General Electric J79-PW-3 engines. Programme officials felt the Arrow could do the same at 60,000ft once the long-awaited Orenda Iroquois engines were installed. The flight-test programme was in such an embryonic state that RCAF test pilot Jack Woodman had flown a mere 2hr 5min in the Arrow. Second RCAF pilot Flt Lt Norm Ronnason had completed his taxiing trials and was

Flight-testing the Orenda PS.13 Iroquois engine

IN A SHINING example of excellent co-operation between Canada and the USA during the Arrow development programme, a USAF Boeing B-47 Stratojet bomber, serial 51-2059, was lent, via the RCAF, to Orenda Engines. The mutual project agreement specified that the PS.13 Iroquois powerplant would be installed in a special aft-fuselage mount and test-flown on the B-47. Orenda officials pointed out that, during the development programme, the company had very nearly matured an engine more advanced than the current Pratt & Whitney J79 at approximately one-third of the cost.

For its time, the engine generated a record amount of thrust – 19,350lb (86kN) "dry" on a testbed, and with afterburner approximately 26,000lb (116kN).

When fully tested, the more advanced Iroquois was slated to be installed on the CF-105, starting with aircraft No 16. The engine had already undergone 5,000hr of ground-testing before being mounted on the B-47. Subsequent flights aboard the B-47 accumulated 31 flight hours before the Arrow programme was cancelled. Canada not only lost a fine interceptor, it also lost a superb new high-technology jet engine.

Orenda Iroquois 2 data

Type Twin-spool turbojet with ten-stage split axial-flow compressor and annular combustion chamber

Length 231in (590cm)

Diameter 42in (110cm)

Dry weight 4,650lb (2,110kg)



Another of the author's superb digital artworks, this one depicting a hypothetical mission over the northern USA, in which a pair of USAF Convair F-106 Delta Darts formate on a visiting RCAF Arrow. The scene emphasises the difference in size between the Canadian and American interceptors.



ABOVE What might have been; the author's depiction of a late afternoon sortie by a pair of Arrows over the western USA includes a USAF variant and an RAF Arrow painted in the colours of the Binbrook Target Facilities Flight. **BELOW** John Diefenbaker was the 13th Prime Minister of Canada, serving from June 1957 to April 1963. It was Diefenbaker, leader of the Progressive Conservative party, who presided over the cancellation of the promising Arrow.

preparing to be assigned a flight when the hammer fell. It was unfortunate that more flights by RCAF pilots had not been arranged earlier.

In Canada the cost of the Arrow programme was by now generating substantial criticism and opposition in many areas, including individuals in the government and RCAF. Eventually the pressure became too much and on "Black Friday" — February 20, 1959 — the Arrow was cancelled. At about 1100hr local time Prime Minister John Diefenbaker announced in the House of Commons in Ottawa that the Arrow and Iroquois programmes were axed. Some 20min later, over the PA, workers at Avro Canada heard the devastating news. An hour or so after the announcement, additional detailed instructions were issued to executives at the Malton Complex from the Department of Defence Production. Essentially, everything involving all phases of Arrow production at Malton, including activities of suppliers/subcontractors, was to cease immediately. All employment associated with the programme was terminated immediately. Avro Canada's senior management had received no warning of this government action.

Avro officials notified the government that the employment of 13,000–14,000 staff was being terminated and that the company had millions of dollars of commitments to subcontractors. As the latter contracts were terminated, an additional



35,000 people would lose their jobs. Plus, there were five completed aircraft being tested, with other CF-105s ready to roll off the production line. Parts were lined up for 37 more aircraft in the factory. Avro Canada officials thought that some type of plan would be introduced, or perhaps scaled-down activity to preserve the advanced work that had been completed. However, a government order was received to destroy everything associated with the programme, including the flyable aircraft, with immediate effect.

More than 50 years on, the controversial story of the Arrow's cancellation is still hard to understand. It is almost incomprehensible to believe that the Arrow could be completely abandoned at a critical point when the programme was just starting to achieve its potential. Additionally, the operational engine which would have greatly increased its performance, the Orenda Iroquois, was nearing flight testing on the prototypes.

Even a scaled-down programme would have preserved the industrial base and talent pool until the budgetary situation improved. This most unfortunate event was undertaken by Canada's own government — then, as if to add insult to injury, every incomplete and flyable test aircraft was ordered to be scrapped and cut into pieces.

If the Arrow had proceeded as planned, who knows what effect it may have had on the USA's

eventual decision to cancel both the North American F-108A Rapier and Lockheed YF-12 Mach-3 interceptor projects? The USAF had continued to monitor the Arrow programme during flight testing, so there was an awareness of the detailed plans for incremental design advances which may have eventually seen the type achieve Mach 3-plus performance. The USA retained the adequate Convair F-106 in service for almost three decades. Both the USA and Canada thought the other was going to leap ahead, but in the event neither followed through on their ambitious interceptor programmes. Meanwhile, the Soviet Union, perhaps sensing less determination from the West, began moving quickly. The Cold War was building momentum and would last another 30 years, at tremendous human and economic cost.

The morning after

When the Canadian government quickly realised that manned fighters were not in fact obsolete, it was too late. Immediately after the Arrow termination order, offers came in from the USA to buy the remaining CF-105s. At the same time the French government wanted to know if it could still expect delivery of 400 Iroquois engines for Dassault's impending Mirage fighter. Diefenbaker was surprised, since he had been assured by his staff and the USA that manned fighters were quickly growing obsolete. Had he been ill-advised? The Diefenbaker administration could have undone the terrible damage from "Black Friday", reinstating the programme for reasons of national security or numerous other spin messages. It could have been done. It was not to be.

Diefenbaker ordered all of the aircraft, tooling, drawings, test records, film and photographs to be either destroyed or confiscated. This included the Iroquois engines. The administration thought that if all of the materials and developed aircraft and engines were gone, the world would soon forget about the whole episode. It reads like fiction, but it actually happened.

The decision had left Canada's defence system choices in a limited and vulnerable position. Ultimately Canada wound up purchasing 56 McDonnell F-101B and ten F-101F Voodoo fighters from the USA — to boot, they were "previously owned" by the Air National Guard. The two-seat CF-101B Voodoo wasn't even close to the performance of the CF-105, and it used the J57 engine that was developed *before* the Pratt & Whitney J75 — which was the interim engine for the Arrow. At the time, the cost of procuring the CF-101B Voodoo was kept hidden from the Canadian public, but was estimated to be about C\$260m. For this amount the Canadian government could have purchased 130 brand-new high-performance CF-105 Arrows.



Avro Canada CF-105 data

Powerplant

CF-105 Arrow Mk 1 2 x Pratt & Whitney J75-PW-3 turbojets, each of 18,500lb-thrust with afterburner

CF-105 Arrow Mk 2 2 x Orenda PS.13 Iroquois turbojets, each of 26,000lb-thrust with afterburner

Crew Two — pilot and navigator/weapons officer

	Arrow Mk 1	Arrow Mk 2
Dimensions		
Span	50ft 0in (15.24m)	50ft 0in (15.24m)
Length	80ft 10in (23.71m)	85ft 6in (26.09m)
Height	20ft 6in (6.25m)	20ft 6in (6.25m)
Weights		
Empty	49,040lb (22,245kg)	45,000lb (20,411kg)
Max take-off	68,605lb (31,120kg)	68,847lb (31,228kg)
Performance		
Max speed	Mach 2 at 50,000ft (15,000m)	Mach 2 at 50,000ft (15,000m)*
Cruise speed	Mach 0.92 at 36,000ft (11,000m)	Mach 0.92 at 36,000ft (11,000m)*
Range	—	408 miles (656km)*
subsonic		264 miles (424km)*
supersonic		
Service ceiling	53,000ft (16,150m)	58,500ft (17,830m)*

Armament 4 x AIR-2 Genie nuclear-armed unguided rockets or 8 x AIM-4 Falcon + 2 AIM-7 Sparrow II 2D guided air-to-air missiles

* projected figures

PROJECT TERMINATED by Erik Simonsen

PROJECT TERMINATED: Famous Military Aircraft Cancellations of the Cold War and What Might Have Been by Erik

Simonsen (Crécy Publishing, ISBN

9-780859-791731,

£23.95/US\$39.95)

examines the

controversies

surrounding the

cancellations of

some of the most

advanced aircraft

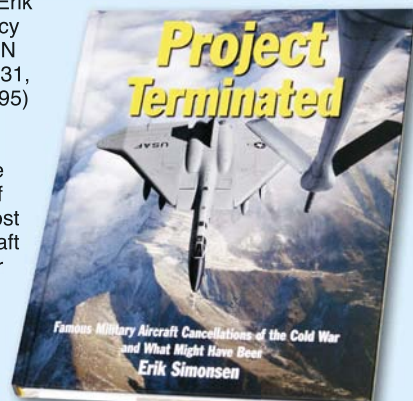
of the Cold War

— and asks

"what if...?"

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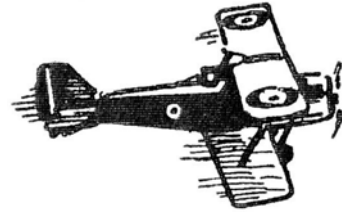


The Royal Aircraft Factory's superb S.E.5 combined excellent speed and agility to become one of the most famous British fighters of the Great War. Less well-known is the story of its equally innovative predecessors. In the first half of his in-depth study* of the development of the Royal Aircraft Factory's series of high-speed "Scouts" from which the first true fighters evolved, **PHILIP JARRETT** describes the genesis of the B.S.1 and S.E.2

PIONEERING THE FIGHTER



*This paper was first presented as the Royal Aircraft Factory Centenary Lecture, delivered before the Farnborough Air Sciences Trust Association at the Village Hotel, Farnborough, on May 22, 2012

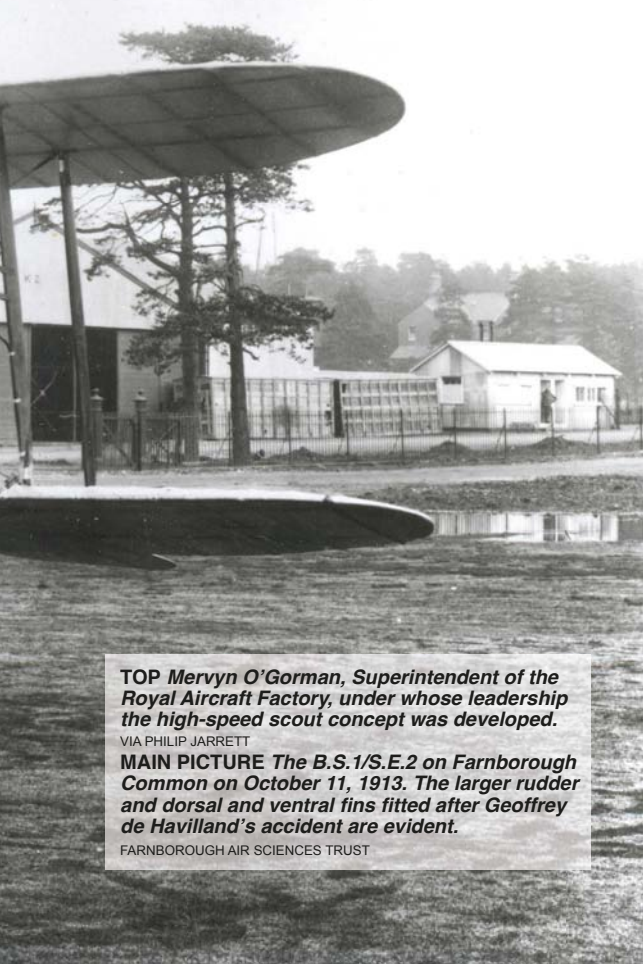


A NOTE ABOUT REFERENCES *Since some of the sources used in the preparation of this history have not been cited for a century, endnote references, indicated by numbers at appropriate places in the text, are provided at the end of the feature*

ON APRIL 11, 1912, in a British Government White Paper entitled *Memorandum on Naval and Military Aviation* (Cd.6067), the Army Aircraft Factory was renamed the Royal Aircraft Factory. That same year this establishment embarked on a project that initiated the birth of a new breed of aeroplane, originally to be described as "Scouts", but later to become better-known as "Fighters". At this initial stage it is necessary to understand how the Scout aeroplane was perceived in the period before and at the beginning of the First World War. In chapter 3 of his book *Aircraft in Warfare*, first drafted in the winter of 1913–14, initially published as a series of articles in the magazine *Engineering* during September to December 1914, and completed in revised form during the first month of the war,¹ F.W. Lanchester writes, under the subheading "The Strategic Scout and its Duties":

"The strategic value of the aeroplane depends mainly upon its utility for the purpose of reconnaissance; briefly it is its value as an informer, rather than as a fighter, that is of service to the headquarters staff. The duties of a machine thus acting are necessarily of an entirely different character from those of a machine employed in the minor operations of the field, whether for tactical scouting, direction of gun-fire, or otherwise. Firstly, the flight range or radius, as determined by petrol capacity, is a far more important factor in its design, since it will require to operate over a large area, and to cover long distances over the enemy's territory, where any renewal of fuel supply is impossible; secondly, its flight speed must be such as to render it reasonably secure against pursuit. Anything serious in the direction of armour or armament will be entirely out of place, since under no circumstances will such a machine be required to act in a combative capacity; its defence lies in its speed."²

Thus we can see that, in those early days, the term Scout described what later became known as a reconnaissance machine, regardless of whether



TOP Mervyn O'Gorman, Superintendent of the Royal Aircraft Factory, under whose leadership the high-speed scout concept was developed.

VIA PHILIP JARRETT

MAIN PICTURE The B.S.1/S.E.2 on Farnborough Common on October 11, 1913. The larger rudder and dorsal and ventral fins fitted after Geoffrey de Havilland's accident are evident.

FARNBOROUGH AIR SCIENCES TRUST



LEFT Geoffrey de Havilland at the time he was designer and chief test pilot at the Royal Aircraft Factory. After building and flying his own Farman-type biplane in 1910, in 1911 de Havilland was employed by the Factory and his assistant, Frank Hearle, was taken on as a mechanic. His biplane was purchased for £400.

RIGHT Henry Phillip Folland (seen here in a photograph taken during the inter-war years) was assistant designer to de Havilland at Farnborough. Folland subsequently designed for British Nieuport and Gloster and in May 1937 his own company, Folland Aircraft, was formed. The company initially built components for the Bristol Blenheim and Beaufort and tailplanes and rudders for the Supermarine Spitfire.

it be a single- or two-seater. In the years ahead, however, the perceived function of the high-speed single-seat Scout changed, and it became an armed fighter. This change is encompassed in the story of the pioneering family of Royal Aircraft Factory aeroplanes which forms the subject of this feature.

THE B.S.1

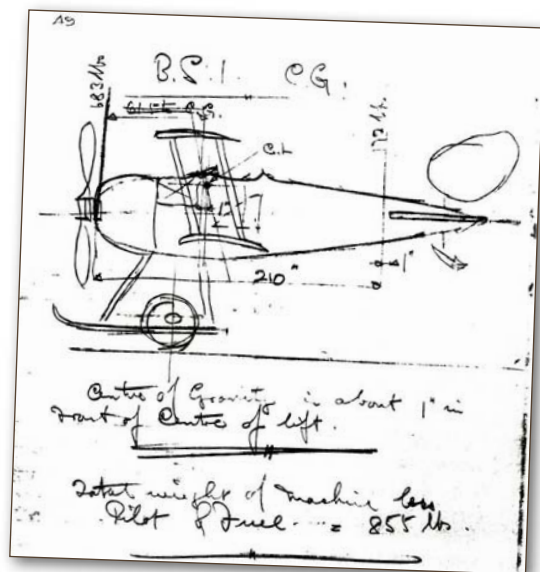
In the summer of 1912 the Factory's draughtsmen began work on the design of a high-speed single-seat biplane, initially designated Blériot Scout No 1, or B.S.1. The prefix was based upon a designation system first proposed by the Factory's Superintendent, Mervyn O'Gorman, in the March 1911 issue of the *Journal of the Institution of Automobile Engineers*,³ in which aircraft with tractor (i.e. nose-mounted) propellers ahead of the wings and tail surfaces, after the style of the classic French Blériot monoplanes, were categorised in "Class B". This system was reiterated in *Aeronautical Research Committee Report & Memoranda No 59* of November 1911,⁴ an initial "E" being appended to denote an experimental aeroplane, thus creating the designation "Blériot Experimental", or B.E.

O'Gorman followed this in January 1912 with a suggested list of aeroplane types that the Factory should build. These included "a high speed aeroplane . . . capable of speeds of at least 90 m.p.h. [145km/h], with a landing speed of not more than 60 m.p.h. [97km/h]". His expressed aim was ". . . to ascertain the advantage of a high-speed machine over a somewhat slower-speed machine in bad weather and also, if possible, to develop the

fastest practical type of machine".⁵ It was probably about this time that the additional classification B.S., initially denoting "a combination of the B.E. and S.E. [Santos Experimental (canard)] formulae in single-seat scout form", was added. It soon came to stand for "Blériot Scout".

In 1913 O'Gorman wrote of the B.S.1: "This aeroplane was constructed as an experiment to obtain data for a high-speed single-seater scouting aeroplane. Its flying speed was designed to be 90 m.p.h. and the landing speed to be less than 50 m.p.h. [80km/h]; that is to say, in the interest of securing a very high speed a certain sacrifice of low speed was made from the standard of 40 m.p.h. [64km/h] hitherto tried for".⁶

Design of the new aircraft, which was to be developed independently of any other aircraft types to keep the experiment separate and distinct,⁷ was led by Geoffrey de Havilland. There appears to be some confusion regarding his starting point for this design. In their *Historical Summary of the Royal Aircraft Factory and its Antecedents: 1878-1918*, Child and Caunter quote de Havilland as saying, in 1946: "I had done most of the design on this machine . . . I had scaled down the tail surfaces from the B.E.1 and the rudder naturally looked absurdly small".⁸ However, in his autobiography, *Sky Fever*, de Havilland recalled: "Aerodynamic knowledge was limited at the time, and in making the drawings I relied largely on scaling down the successful B.E.2. This method was good enough for wings and tailplane but not for rudder which looked obviously too small when the machine was



ABOVE The centre-of-gravity diagram for the B.S.1 from Folland's notebook; an early if rough impression of its appearance. The aim of minimising drag by having a clean, streamlined fuselage is apparent. Although de Havilland led the design, Folland was responsible for much of the detail work.

FARNBOROUGH AIR SCIENCES TRUST/WWW.AIRSCIENCES.ORG.UK

assembled".⁹ Contrary to this, historian J.M. Bruce has written that: "In side elevation the B.S.1 was almost pure B.E.3, the outline being only slightly altered to accommodate the single cockpit and to refine the lines at the tail. The rudder echoed the oval shape of the B.E.3's control surface and was similarly mounted as a balanced unit without fin".¹⁰

One might of course be tempted to accept the designer's own statements, but they are distant recall, and also inconsistent. On the other hand, Jack Bruce's assessment is validated simply by comparing photographs of the B.E.3 and B.S.1. It seems that the accuracy of de Havilland's memory is questionable.

THE NEW MACHINE DESCRIBED

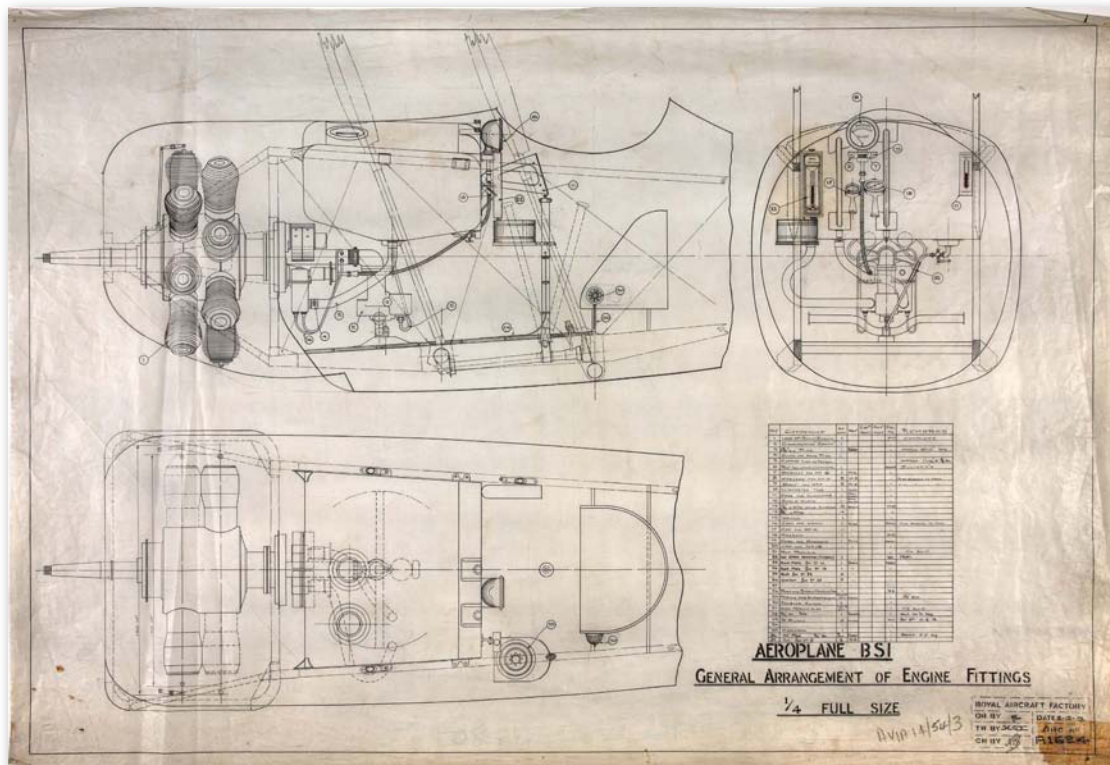
While overall responsibility for the design lay with de Havilland, who was also the Factory's chief test pilot, much of the detail design work was undertaken by Henry Phillip Folland, who had recently joined the staff of the Senior Drawing Office. Work on the design started in the summer of 1912, and detail design of the mainplanes was complete by August 21, 1912. Folland's design notebooks contain an early rough impression of the B.S.1 with his centre-of-gravity calculations for the machine. Although this is almost a caricature of the actual aircraft, the streamlining is apparent.¹¹ One of the actual Factory drawings for the B.S.1, a side elevation dated October 5, 1912, makes this even more obvious. Also evident are the design's compactness and the attention to detail.¹²

The semi-monocoque fuselage, 20ft 5in (6.2m) long, comprised a front and rear section. The front consisted of a wire-braced box girder with spruce upper longerons and a pair of deep lower spruce bearers that incorporated the steel tubes to which the lower wing-root stubs were attached. The tubes for the rearmost lower wing spars were attached under the bearers, so that the wing was fitted at the required angle of incidence. Staggered steel-tube spacers linked the bearers and upper longerons.

The engine was mounted on the front of this structure, and its front bearing was supported by a pair of substantial broad horizontal fore-and-aft bearers incorporating and braced by a triangular arrangement of steel tubes on each side, attached to an oblong horizontal steel-tube frame, all of the tubing being of 1in x 20 s.w.g. The bracing triangles diverged, so that the engine-mounting frame opened out towards the front, where it was significantly wider than the main fuselage box girder to which it was attached.¹³

Although a 100 h.p. two-row 14-cylinder Gnome rotary engine was installed, the engine mounting and cowling were made sufficiently large and strong to permit the greater-diameter 140 h.p. Gnome to be fitted if desired. A drawing shows two two-bladed propellers bolted together to form a four-blader, but only a two-blader was fitted on the finished machine.

The forward fuselage girder finished at the spacers behind the cockpit, but the longerons and lower bearers extended aft a further 3ft (0.9m) to provide anchorage for the rear fuselage section.



ABOVE This detailed drawing of the B.S.1's forward fuselage, dated October 2, 1912, shows the installation of the two-row Gnome rotary engine, the position of the fuel/oil tank and the location of the instruments and controls.

THE NATIONAL ARCHIVES, REF. AVIA14/54/3

OPPOSITE PAGE A revealing open side elevation of the B.S.1 by Royal Aircraft Factory draughtsmen. Although radius rods are shown on the undercarriage, they do not appear to have been fitted on the aircraft as built.

THE NATIONAL ARCHIVES, REF. AVIA14/54/5

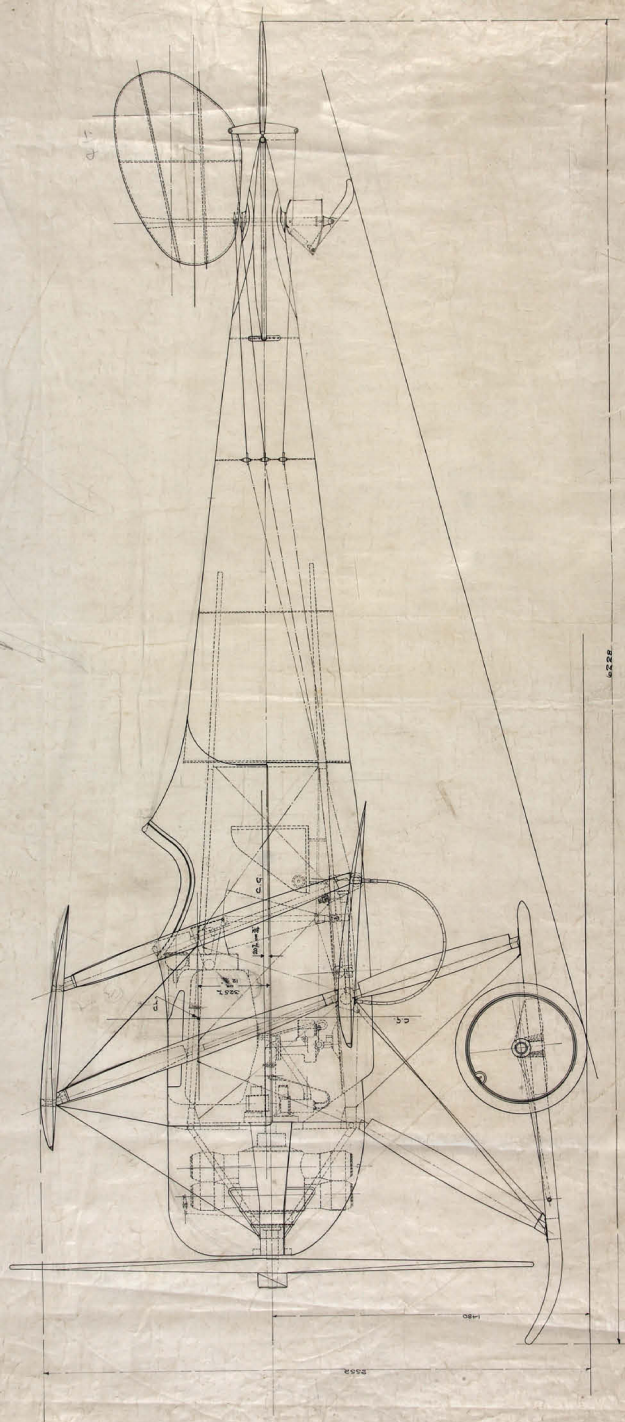
This was a true monocoque, comprising a pre-formed birch-ply skin on four formers.

Immediately behind the rear engine mounting were the stationary engine components and a Zenith carburettor, an access panel to this area being provided in the lower fuselage side. Above this was a fuel tank, with a gravity feed to the carburettor. This tank was divided longitudinally, the starboard side holding 21½gal (98lit) of petrol and the port side containing 11gal (50lit) of oil. As there was no instrument board as such, most of the cockpit instruments were attached directly to the rear face of the tank. These comprised an Elliot revolution counter, a vertical-column airspeed indicator, a watch and an aneroid (altimeter). A clinometer (measuring ascent and descent in degrees) was attached to the starboard top longeron, and a compass was affixed to the rearmost steel-tube vertical spacer on the port side. The ignition switch was fastened to the forward port side of the pilot's bucket-seat. The pilot operated the wing warping lateral control and the elevators for control in pitch by means of a control column, which had a blip switch in its top to allow the engine to be switched on and off to provide a basic form of "throttle" speed control. A foot-operated rudder bar gave control in yaw. The cockpit had a tongue-and-grooved wooden floor.¹⁴

With the engine enclosed by a semicircular cambered metal engine cowling, cut away on the underside, and the internal girder structure of the front fuselage section faired to circular cross-section by plywood skinning attached to formers so that there was a smooth transition to the monocoque rear section, the finished fuselage had exceptionally clean lines for its time.

The fabric-covered semicircular tailplane carried a one-piece elevator which possessed a curved trailing edge. There was no fin; only a balanced ovoid rudder reminiscent of that on the B.E.3 but significantly smaller, having an area of only 4½ft² (0.4m²).

The wing comprised a single-bay cable-braced biplane structure having a span of 27ft 6in (8.4m), a chord of 3ft 9½in (1.15m), an incidence of 4° and a gap of 4ft 7in (1.4m). Four faired struts attached to the upper longerons supported the upper wing centre-section, and pairs of faired interplane struts were fitted toward the wingtips. Overall height from ground level to the top of the upper wing was 8ft 4½in (2.6m). The fabric-covered wing panels had two spars and were of RAF 6 aerofoil section. The leading and trailing edges were parallel out to the interplane struts, but the tips were oval. Bamboo bows were attached beneath



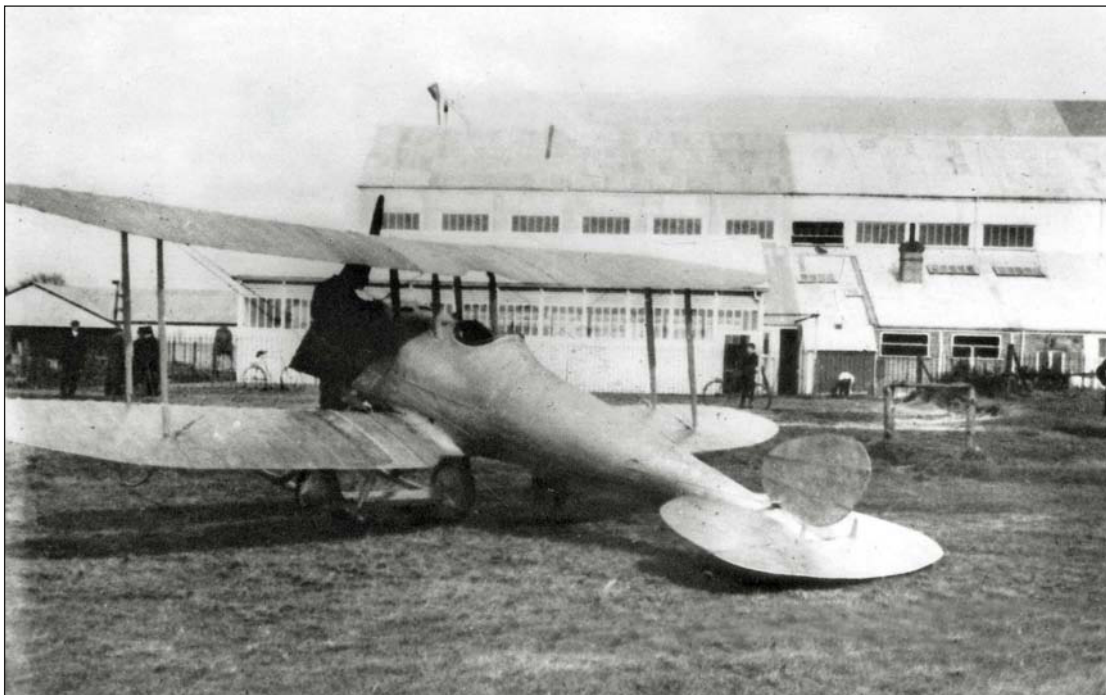
GENERAL ARRANGEMENT OF AEROPLANE B.S.I.

SCALE $\frac{1}{8}$ FULL SIZE

SIDE ELEVATION

ROYAL AIRCRAFT FACTORY
 DESIGNED BY *[Signature]* DATE 5-1-18
 TR. BY *[Signature]* CORR. NO.
 CHIEF *[Signature]* A1640

AVIA 1545



ABOVE *Small but perfectly formed — the B.S.1 had exceptionally clean lines for its time and was remarkably compact, as the man standing in the shadows at the aircraft's nose emphasises. The fairing of the lower wing root into the fuselage is well shown here, and the very small rudder and the absence of a fin are conspicuous.*

the lower wingtips, in line with the front and rear strut attachment points, to protect the wingtips from damage should the aeroplane heel over on the ground.

The main undercarriage was a sturdy wire-braced twin-skid structure carrying two bungee-sprung wheels, the wire spokes being fabric-covered. Although radius rods are indicated on the drawing, they are not visible in photographs of the completed machine. Beneath the tailplane there was a strut-mounted bungee-sprung tail-skid with its upper structure covered by a neat aerodynamic fairing; an unusual refinement for the time which attests to the designer's desire to minimise drag.

INTO THE AIR

Inevitably the finished product differed from the drawings in some details. Its wings were rigged with a small amount of dihedral (one source says $2\frac{1}{2}^\circ$), the tailplane was of greater chord, the fuselage emergence points of the rudder cables and top elevator cables were transposed, and the undercarriage axle was covered by a streamline fairing. A pitot head was attached to the port front interplane strut. The aircraft was stressed to a maximum factor of safety of three, and weighed 850lb (386kg) empty, 5lb (2.3kg) less than calculations had predicted. A diagram of curves of resistance and power for the B.S.1 in *R & M No 86* gives its loaded weight as 1,220lb (553kg) and also cites a surface area of 190ft² (17.7m²), an

aspect ratio of 7.3:1, a stagger of 14° and a "gap chord" of 1.2:1.¹⁵

The B.S.1 was completed early in 1913 and flown by de Havilland. Unfortunately the date of its maiden flight has not been recorded, but de Havilland stated in 1946 that: "... during the first flights [I] found that directional control was bad. I do not think in those days there was much theoretical knowledge about control surfaces and fin areas ... 'Calculating by eye', coupled with bad directional control, made me decide to have a larger rudder put in hand".¹⁶ In his autobiography he added: "I did not think the small rudder would lead to any serious trouble, but might not be sufficiently effective in sharp turns. I did the first test flight with the small rudder and noticed that big rudder angles were required to correct a turn".¹⁷ See page 43 for O'Gorman's report.

The drawing for a larger rudder was completed by March 25 and passed to the workshops for its construction to begin. By this time the aeroplane had been redesignated S.E.2, standing for Scouting Experimental No 2.¹⁹ Incidentally, Folland was also working on the design of a larger aircraft, the B.S.2, with a steel-tube fuselage and a Renault engine; this may have been redesignated R.E.1.

Plans were overtaken by events. On the morning of March 27 de Havilland made further speed and climbing trials, and later in the afternoon he took off to undertake further trials. That same evening O'Gorman described what ensued in a telephoned report to Maj-Gen G. Scott-Moncrieff, RE,

REPORT ON THE FIRST FLIGHT OF THE B.S.1

THE B.S.1 MADE its first flight in early 1913. Reporting on the aircraft's performance, O'Gorman wrote:¹⁸

"The control is by single universal lever for warp and elevation, together with rudder control for the feet; and it is arranged with ground rudder.

Carrying a 12-stone pilot and sufficient fuel and oil for three hours, the following results were obtained:

- (1) Average speed, 91.7 m.p.h. [146.5km/h]
- (2) Slow speed, 51 m.p.h. [82km/h]
- (3) Rate of climbing, 900ft [275m] in one minute

The high speed is satisfactory, and experiments have shown that with the same motor (a Gnome of 100 nominal h.p. giving about 82 b.h.p.), the speed might be increased considerably by diminishing the head resistance of the front of this aeroplane, as the existing front was made large and strong enough to take a 140 h.p. motor.

It has been found that to fly slowly in any aeroplane requires a certain amount of familiarity with the machine, and, accordingly, as the 51 m.p.h. was the first slow test that the pilot had made, it is thought that it can probably be bettered in subsequent flights. It was difficult to throttle down the Gnome engine of that day to get the best results for slow flying, except by the process of switching on and off spasmodically. The aeroplane can be landed at a speed somewhat less than this, say, not exceeding 49 m.p.h. [79km/h].

The rate of rising of 900ft in one minute was obtained at a speed of 65 m.p.h. [105km/h] through the air. It is thought that this result is remarkable. The RAF [i.e. Royal Aircraft Factory] graphs of this machine indicate that even better results can be obtained at a rather slower speed, but this has not been tried.

Controls — The pilot, Mr de Havilland, reported that the machine was easy and light to handle in the air. Steadiness fore and aft and easy lateral control were reported. The amount of self-warping [i.e. the tendency for the wing to warp without any pilot input] had been regulated by adopting the position of the front spar found by experiments on B.E.2 and was considered about right.

Rudder — The pilot had reported that the rudder was somewhat small. This would be due to the fact that it had to balance the large projecting engine case and propeller forward of the centre of gravity, but having found that he could easily check any tendency to turn too much, he considered the aeroplane safe to fly."

the Director of Fortifications & Works, in London:

"I have to report an accident today about 5 o'clock to the new fast 'Scout' which will delay that experiment at least a month, though fortunately the pilot Mr de Havilland has escaped with two badly strained ankles and the loss of some teeth so far as can be ascertained at present.

"Only this morning a repetition of the speed trials proved 92 m.p.h. [148km/h] on eight to-and-fro flights. The aeroplane was then tried for climbing and showed on the instruments a rise of 800ft [244m] in one minute. The slow speed as yet attained was not the best, being 50 m.p.h. [80km/h]. This was to be re-tested in view of visits from General Henderson and Captain Sueter, RN, tomorrow.

"I surmise some derangement of rudder because three small circles were described down to the ground making a bad landing, smashing first the skids and then the body work.

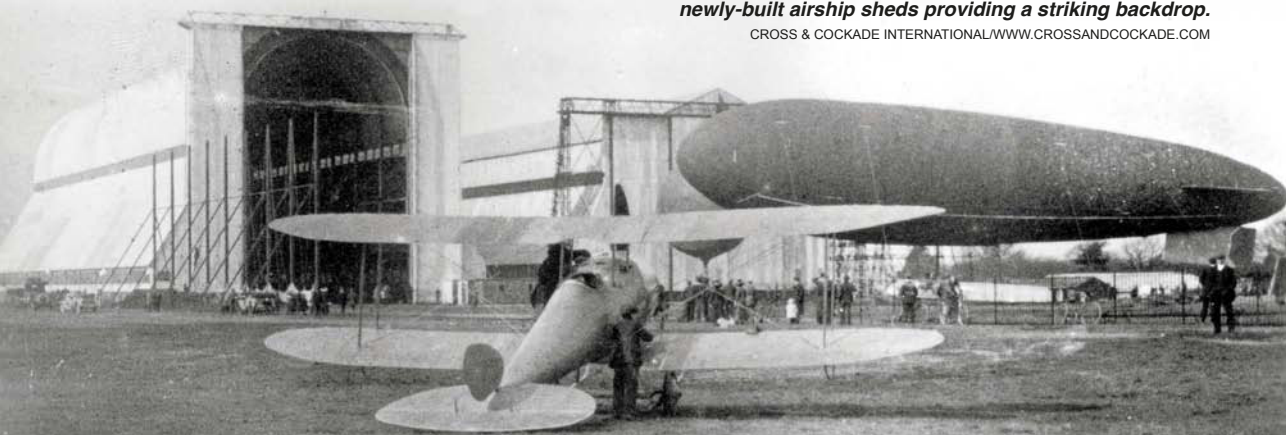
"It is with much regret that I report this, and I wish to place on record that Mr de Havilland is an absolutely steady and admirable flyer who never has indulged in display or fancy flights and banking."²⁰

Geoffrey de Havilland was admitted to Cambridge Military Hospital in Aldershot, where it was found that he had also suffered a broken jaw. In his autobiography de Havilland wrote of the accident:

"In doing a rather sharper turn than usual the aeroplane suddenly took charge and went into a

The B.S.1 outside the Royal Aircraft Factory compound with the Gamma II airship, a spherical gas balloon, and the newly-built airship sheds providing a striking backdrop.

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ABOVE A port side view of the S.E.2. Note the access panel for the engine auxiliaries immediately behind the cowling. There was no tailskid as such, the lower end of the rudder being shod with steel to serve that purpose. Although not unusual at the time, it was not a good idea, as it imposed undue stresses on the rudder and its hinges.

spinning turn which full opposite rudder failed to halt. As I was below a hundred feet there was no hope of getting out of the spin, which luckily was fairly 'flat' when we hit the ground. I remember the sensation due to centrifugal force of being pressed hard against the side of the cockpit during the spin, and knew nothing more until dragged from the wreckage. The chief damage I suffered was a broken jaw and the loss of many teeth (later found in the wreckage and kindly returned in an envelope by a mechanic) and some bruises, but the aeroplane was a total wreck.

"While recovering in the Cambridge Hospital at Aldershot I had a visit from one of the technical people from the Factory who said, with a certain note of triumph, that they had made extensive calculations and the results proved that the rudder was too small. I tried to show interest."

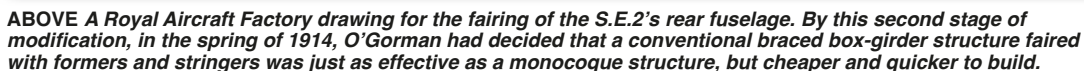
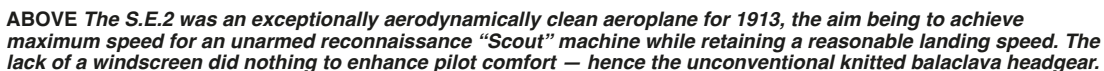
He added: "Mervyn O'Gorman also came to see me at the hospital and kindly brought a gramophone and a pile of records. But I think I most appreciated a book by H.G. Wells which he gave me. On the title page was written 'To G. de Havilland from M. O'G. In memory of an aeroplane. 92—50—900'. The figures referred to the performance we had measured: 92 miles per hour top speed, 50 miles per hour slow speed, and nine hundred feet per minute, climb. The climb was phenomenal for those days. I appreciated the words on the title page more than the contents of the book."²¹

Describing and further analysing the accident in 1913, O'Gorman stated:

"This smallness of the rudder was a contributory cause of the accident which disabled the machine. The sum of the fin effects in front of the centre of gravity could, when the engine was working at full power, outbalance the sum of the directional effects aft. After several successful flights, a tyre puncture led to a workman unfortunately replacing the small wheels by larger ones. These, being filled in at the sides, increased the fin effect forward, and when the machine was yawed by turning sharply under power, the combined fin effect forward of the body and propeller was greater than could be overcome by the rudder. This caused the machine to carry on in a circle and occasioned the accident. This is to be expressed as a side-slip outwards, and is the converse of side-slip inwards, which would terminate in a nose dive, and would arise from excess of fin aft."²²

Some time after the crash, calculations were made and windtunnel tests were undertaken at the National Physical Laboratory on a scale model to assess the aerodynamic characteristics of the B.S.1 (although the model tests were made only on the body of the succeeding S.E.2). O'Gorman subsequently reported:

"... the body resistance at maximum speed is more than double the resistance of the planes. This is in spite of the great care which has been taken to reduce all resistances, and it shows that much may yet be gained if simplification of bracing (by the use of stronger materials), and better fairing of landing gear can be secured.



"Another point to notice is the smallness of the angle of incidence at full speed. This is slightly less than half a degree . . . There is no objection to the use of these small angles, nor has any appeared on practice, always pre-supposing that provision has been made for overcoming the increased movement of the centre of pressure for any change of angle, by the use of a rather larger tailplane."²³

Referring to the B.S.1's lateral stability characteristics, O'Gorman stated:

" . . . it will be seen that the negative directional moment was so great that the aeroplane had a comparatively small margin of directional stability when the rudder was held straight. This was of small importance in itself, the aeroplane being quite controllable; but, if a large yaw arose, the large negative directional moment necessitated the rudder being held almost straight. The rudder has then also a large angle of incidence. Any increase of this angle, such as might occur in checking the angular velocity, would bring the rudder to the 'burble' point, when its lateral force would at once fall and control be lost. This, aggravated by the fin [area] introduced by the change to larger wheels is . . . what probably caused the accident to this machine.

"The small aspect ratio of the rudder and its position in the wake of the body and propeller would cause the 'burble' point to be reached at a smaller angle.

"It is possible, in addition, that the characteristics

were somewhat worse than those shown, as the method of evaluating them had not been evolved when the aeroplane was designed, and model tests were only made on the body of [the] S.E.2. It is difficult to avoid error when computing the characteristics of one body from those of another of different shape."²⁴

O'Gorman added that: "One of the chief causes of the large negative directional moment in [the] B.S.1 was the large high-pitch tractor screw".²⁵

RECONSTRUCTION OF THE S.E.2

On March 28, the day after the crash, O'Gorman submitted a minute to the Director of Fortifications & Works, saying:

"I propose to put in hand at once the repairs to [the] S.E.2 machine, the new fast Scout which met with an accident yesterday.

"I am inclined to think that for present purposes the speed attained by this aeroplane is too high for any but pilots with exceptional experience. I should therefore prefer to fit an 80 h.p. Gnome engine to this machine instead of the 100 h.p. when reconstructing it. With this engine the speed of the machine will be reduced to something over 85 m.p.h. [137km/h], and the slow landing which it has already accomplished will be even better.

"As the next step forward in scouting aeroplanes, I think it would be desirable nevertheless to put in hand a similar type machine with the new ninety-cylinder 100 h.p. Gnome engine, and in order to

The rebuilt S.E.2 with its further revised tail surfaces. Its military serial number, 609, is chalked or painted in small numerals at the top of the rudder. The spinner on the hub of the finer-pitch propeller is of increased diameter, but space has been left to admit cooling air for the engine.

PHILIP JARRETT COLLECTION



carry on the sequence of experiments with this fast type of machine, I should like to have authority to put the work in hand at once."²⁶

O'Gorman estimated that the repairs to the S.E.2 would cost £900, and that a new 80 h.p. Gnome would cost £425. The designation S.E.3 was reserved for the proposed new aircraft with the 100 h.p. Gnome, the costs in this case being £1,400 for the airframe, including construction, and £650 for the engine. These estimates were approved on April 25, 1913.²⁷ By this time the designation S.E. signified "Scouting Experimental".

The principal aims behind the rebuild, to which Edward T. Busk, the Farnborough scientist-pilot who was conducting experiments in automatic stability, contributed some calculations and suggestions, were expressed by O'Gorman in his 1913 report:

"This aeroplane has been rebuilt with the modifications to the body design which experience has suggested, and one of these is the use of a larger rudder.

"The reconstructed machine (S.E.2) is fitted with a Gnome of 80 h.p. nominal instead of the larger engine, as the improvement will, it is hoped, enable similar results to be obtained without any important sacrifice of speed, namely, with the smaller motor 85 m.p.h. will be obtained and the landing speed will be kept lower, viz, less than 47 m.p.h. [76km/h] with a climbing speed of 780ft [238m] a minute. It is thought that a slightly

smaller step in the direction of increased speed will give a machine which will be more easily learnt and managed.

"In [the] S.E.2 the smaller tractor [propeller] and the presence of small triangular fins ahead of the rudder make the negative directional moment considerably smaller. In addition, the rudder is larger and of better aspect ratio, and on referring to the lateral stability curve, it will be seen that for large angles of yaw, the rudder, when held straight, gives at least ten times the effect necessary to reach neutral stability."²⁸

At the time this report was compiled it was expected that test flying of the S.E.2 would begin during November 1913, but on July 25 O'Gorman predicted that the repairs and modifications would be completed by about August 3. However, this seems to have been over-optimistic, as it appears unlikely that the work was completed much before October 11, the date the S.E.2 was photographed at Farnborough.²⁹

The aircraft's strong resemblance to its forebear was evident. The fuselage was not altered substantially, but the aircraft's overall length had been increased from 20ft 5in (6.2m) to 20ft 10in (6.3m) as a result of the undercarriage being moved forward. The upper section of the forward fuselage covering was extended rearwards. The 80 h.p. Gnome was housed in an all-round cowling of deep chord but well shaped, and a small spinner was affixed to the propeller boss. As O'Gorman had described, completely new tail surfaces were fitted. A tall high-aspect-ratio welded-steel tube and sheet-framed fabric-covered rudder of increased area, with a curved trailing edge, was hinged to a steel-tube rudder post, and there were fixed triangular fins with a total area of $4\frac{1}{2}\text{ft}^2$ (0.4m^2) above and below the fuselage. The lower extremity of the rudder was shod to serve as a tailskid, the surface having some freedom of travel on the post, against a steel coil spring with an extended length of 7in (18cm).

The elevators, of similar construction to the rudder, had a total area of $15\frac{1}{2}\text{ft}^2$ (1.45m^2). Each one had slight inverse taper. They were carried at the trailing edge of a semicircular tailplane with an area of 25ft^2 (2.3m^2) and marked undercamber. Its leading and trailing edges were formed from mild steel tubing, and it had a spruce main spar and ribs built up of ash and spruce.

The span, chord and gap of the single-bay wings were the same as for the B.S.1, but the incidence was reduced to 3° . The stagger was 20° , and the total wing area was 188ft^2 (17.5m^2). Some additional bracing was provided. The bows beneath the lower wingtips were omitted. The empty weight had been estimated at 747lb (339kg), but proved to be 720lb (327kg); the loaded weight was 1,132lb (513kg), giving a wing loading of



5.95lb/ft² (29kg/m²). As the tankage remained apparently unchanged, the petrol and oil capacities stayed the same.³⁰

TO THE MILITARY WING

Geoffrey de Havilland was flying the S.E.2 during October 1913, and by November 5 O'Gorman was able to report to the Assistant Director of Military Aeronautics (ADMA):

"The S.E.2 is made and finished testing. I have also invited Captain Longcroft, RFC [Royal Flying Corps], to fly it, which he has done at Farnborough (with the consent of OC, RFC). The gain in weight of using the better and smaller engine has given the aeroplane a better slow speed and its climbing is nearly as good as with the 100 Gnome.

"Sundry improvements suggest themselves, of course, notably, as the result of Advisory Committee experiments I can dispense I think with the extensive and slow (to build) form of fuselage called monocoque in favour of a fuselage more like the R.E.1 while making it at least equally strong.

"May I please have the 160 Gnome asked for aeroplane *Scout High Speed* promised by 1st March? I do not yet want to part with this scout S.E.2 as I use it for trials in connexion with the new High Speeder, but if OC RFC wishes further experience in it for his picked flyers I can put it at their disposal here whenever not being worked on."³¹

This report anticipates the further modification that the S.E.2 was to undergo in 1914, and also modifications to the higher-powered S.E.4, which might have been only in the design stage at the time.

It is evident that there was already an interest in the S.E.2's military potential, even though it was intended purely as an experimental machine. Indeed, late in 1913 Major W. Sefton Brancker, who was General Staff Officer 2 in M.A.1 (Directorate of Military Aeronautics) at the War Office, minuted M.A.2 with regard to the S.E.2 being flown by pilots from the Military Wing of the RFC, requesting that a definite order be given to O'Gorman, requiring him to issue the aeroplane to the Military Wing. Brancker also requested that the Officer Commanding the Military Wing, Lt-Col F.H. Sykes, should report on the S.E.2 in due course, and added that the machine's "possibilities as a bomb dropper" should be pointed out to O'Gorman.³²

Consequently, on December 23 the ADMA issued an instruction that the S.E.2 be handed over as requested. Clearly reluctant to have his promising experiments interrupted, O'Gorman nonetheless consented, but in his response, on January 1, 1914, he pointed out:

"Provided it may be clearly understood that the aeroplane S.E.2 is an experimental study and not turned out suitably for service purposes this

machine could be handed over as soon as the skid which is broken has been repaired. This skid is being steamed for bending. It will be ready on Wednesday next week.

"Matters to which attention are drawn are:

(a) the cowls are cracked and are in poor condition and should be watched;

(b) the airscrew should be a four-blader instead of two, as the vibration in turning with the two-blader is severe — my flyers always switch off on sharp turns;

(c) the body is somewhat out of repair as it consists of built-up three-ply;

(d) instruments are on a rough board and are experimental.

"I think this aeroplane ought preferably not to stay away from this neighbourhood so that it may, when required, be attended to. It is not particularly suitable for bomb-dropping."³³

By the time the S.E.2 flew with No 5 Sqn in January 1914 (see panel on page 51) it had probably been allocated its military serial number, 609. In mid-March it was flown to Netheravon by Maj J.F.A. Higgins, who, along with Lt N.J. Gill, had flown it frequently in the RFC. Apparently the aircraft was not flown at Netheravon. On March 20, 1914, O'Gorman reported to M.A.2 that 609 was to be returned to the Factory for modifications, and Higgins flew it back to Farnborough early in April.³⁵

COST AND BENEFIT

The cost of these modifications was put at £150 for labour and £80 for materials, but it transpired that repairs were also required, adding another £120 for labour and £50 for materials. When £45 for an engine overhaul was added, the total cost came to £445, but the reconstruction of the S.E.2 was extensive. The original monocoque rear fuselage was replaced, as O'Gorman had recommended, by a faired fabric-covered structure built up on a spruce wooden box girder comprising four longerons with vertical and horizontal spacers. While the sides of the girder were wire-braced, the top and bottom were faced with plywood, thus eliminating the need for wire bracing. The rear fuselage was built out to circular cross-section by formers and stringers.

Once again the tail surfaces underwent a substantial change. The vertical upper and lower fins were enlarged, and a rudder of much greater chord was fitted. The constant-chord tailplane and elevators had raked tips which would set the style for the later S.E.-series aircraft. A separate tailskid was mounted on an extension of the rudder's leading edge, with its spring covered by a fairing, as in the original B.S.1.

The engine cowling apparently remained the same, but a slightly larger spinner was attached to



This photograph of the S.E.2 as 609 clearly shows the fabric-covered conventional rear fuselage that replaced the monocoque structure. Although a separate tailskid has now been fitted, it is attached to an extension of the rudder leading edge, rather than to the tail end of the fuselage frame, so there is still a danger of straining the rudder structure and its attachment.

the boss of the finer-pitch propeller, further enhancing the streamlining. The undercarriage was little changed, but it was fitted with new struts and skids.

Although the wings were apparently unaltered, additional bracing was provided. More noteworthy was the use of streamline-section wires (soon to become known as "Rafwires" in acknowledgment of their origin) in place of the stranded-wire cables which had been used hitherto. The S.E.2 was one of the first aircraft to have this refinement.

TO FRANCE

Britain was at war by the time the reconstructed S.E.2 flew. Its first recorded flight was made by Farnborough test pilot Frank Goodden on October 3, 1914, and lasted 15min. Although a skid was broken during the landing, the aircraft was airborne again on the 5th, with Geoffrey de Havilland, now chief aeroplane tester with the Aeronautical Inspection Department, in the cockpit. On the following day Goodden flew it twice and de Havilland once, and de Havilland made further short flights on October 15, 18 and 20, the last of these flights bringing the total flying time of the reconstructed S.E.2 to 2hr 20min.

Such was the RFC's desperate need for aeroplanes on the Western Front that 609 was sent to France, even though it was a little-flown experimental aeroplane. On October 27 it joined No 3 Sqn at Moyenneville, where it drew the attention of Air Mechanic James McCudden, destined to become a great fighter pilot. Writing in his book *Five Years in the Royal Flying Corps*



(later republished as *Flying Fury*), he recalled:

"... an S.E. joined No 3 Squadron at Moyenneville and was fitted with two rifles in the same way as the Bristol Scout to which I have previously referred. This S.E.4 [sic] was the first machine on active service to be fitted with the RAF streamline wire. It was fitted with an 80 h.p. Gnome, and was a little faster than the Bristols with the same engine, but did not climb quite as well."³⁶

The S.E.2 went back to the Aircraft Park on October 31, presumably for repair, and returned to No 3 Sqn on November 18. A photograph of it with No 3 Sqn, which has been captioned "Lt Shekleton's S.E.2a [this designation was never used officially], Xmas 1914, at Cliogues, behind Béthune", shows it armed with only a service revolver in a holster, attached outside the cockpit on the starboard side. On March 12, 1915, it was damaged by the explosion of a bomb on No 3 Sqn's aerodrome, and on March 16 it was returned to the Aircraft Park with its logbook. On March 24 it was sent back to England, being struck off the strength of the RFC in the Field.³⁷

The S.E.2's lack of proper armament and gun mountings meant that it could never have shown any potential as a fighting aeroplane; it could only have been seen as a fast scout. Its subsequent career is obscure, but in 1918 it was listed as a type for preservation. Sadly, even if it was still in existence at that time, it was not preserved.



NEXT TIME — the evolution from scout into fighter; and the development of the Royal Aircraft Factory's S.E.4 and S.E.4a, progenitors of the S.E.5/S.E.5a

TOP Royal Aircraft Factory test pilot Frank Widdenham Goodden.
BELOW The S.E.2 in service with No 3 Sqn RFC at Cliogues. Note the roundel on its rudder and the holster for a revolver attached outside the cockpit. PHILIP JARRETT COLLECTION x 2



NO 5 SQN RFC REPORT ON FLYING THE S.E.2

THE S.E.2 WAS handed over to the Military Wing on January 17, 1914, Lt-Col F.H. Sykes submitting the following report to Gen Sir David Henderson, the Director General of Military Aeronautics (DGMA), on March 7 the same year.³⁴

"[The] S.E.2 has been flown by four officers of No 5 Squadron. They report that the aeroplane is easy to fly and not difficult to land. If this is done at a moderate pace — say about 50–60 m.p.h. [80–95km/h] — it does not run far after landing. The difficulty is to get the machine gliding slowly, owing to its good gliding angle and low head resistance.

For this reason it would be hard to get the machine into a field surrounded by trees, telegraph wires, etc, unless it was a very large one.

If only surrounded by a 5ft [1.5m] hedge it could be landed in quite a moderate-sized field.

The machine vibrates when turning to the left, unless it is banked to the correct angle; it does not bank itself. It does not vibrate when turning to the right.

The machine has been flown in a wind of 12–33 m.p.h. [19–53km/h] by the RAF wind-gauge at Pyestock and also in one of about 25-40 m.p.h. [40–64km/h]. It behaved very well and did not seem much affected by gusts, and would, it is believed, be quite safe in strong winds.

As regards the fittings, etc, the cowl acts very effectively in keeping the oil from the pilot.

A small mica windshield would much add to the comfort of the pilot; it need only be about 3in [7.6cm] high.

The auxiliary switch, or cutout, at the top of the control lever is very convenient.

The petrol control (by rack) is good but would, it is felt, be even better if it was arranged fore-and-aft instead of up and down.

The field of view from the machine is good as far as seeing the ground goes, but it is impossible to see anything directly in front when on the ground, or when climbing at all, in the air. Perhaps two small mirrors might be arranged to remedy this."

REFERENCES

- 1 This account of the book's origins is taken from a duplicated typescript "review" of the book written by Lanchester 25 years later, a copy of which has been inserted in a first edition of *Aircraft in Warfare* in the author's possession
- 2 Lanchester, F.W., *Aircraft in Warfare: The Dawn of the Fourth Arm* (Constable, London, 1916), p19. The author believes this to be the first usage of the word "fighter" as a noun to describe a specific class of aeroplane
- 3 O'Gorman, M., "Problems Relating to Aircraft", *Journal of the Institution of Automobile Engineers*, March 1911, pp257–307
- 4 O'Gorman, M., "Experiments with Full-scale Flying Machines", *Advisory Committee for Aeronautics Reports & Memoranda No 59*, HMSO November 1911. Despite previous statements to the contrary, the "B.S." designation does not appear in this report
- 5 O'Gorman, M., "Suggested Aeroplanes for Construction at [Army] Aircraft Factory", The National Archives AIR 1/730/176/5/92
- 6 O'Gorman, M., "Report on Full-scale Work", *Advisory Committee for Aeronautics Reports & Memoranda No 86*, March 1913; p265 in the collected reports in *Technical Report of the Advisory Committee for Aeronautics for the Year 1912–13*, HMSO, 1914
- 7 O'Gorman, M., "Full-sized Experimental Constructions Proposed to be Made at Army Aircraft Factory", 1912, The National Archives DSIR 23/162
- 8 Child, S., and Caunter, C.F., *A Historical Summary of the Royal Aircraft Factory and its Antecedents: 1878-1918*, Report No Aero 2150, Royal Aircraft Establishment Farnborough, March 1947, p17
- 9 de Havilland, Sir G., *Sky Fever* (Hamish Hamilton, London, 1961), p89
- 10 Bruce, J.M., "Ancestors of the S.E.5, Part 1", *Aeroplane Monthly*, July 1976, p349
- 11 Folland, H.P., *Facsimile of Aircraft Design Notebook of H.P. Folland While Serving at the Royal Aircraft Factory from 1912 to 1916*, arranged by Wg Cdr C.F. Unwin (Publication No Museum 2, RAE Museum, Farnborough, 1971, 4 vols), Book No 1, p49
- 12 Royal Aircraft Factory drawing No A 1640, "General Arrangement of Aeroplane B.S.1", 1/6th full size, dated 5/10/1912
- 13 Ibid and Royal Aircraft Factory drawing No A 1624, "Aeroplane B.S.1", general arrangement of engine fittings, side elevation, scale 1/4 full size, dated 2/10/1912, and Folland, H.P., *Facsimile of Aircraft Design Notebook*, op cit, p17
- 14 Ibid, Royal Aircraft Factory drawing No A 1624
- 15 O'Gorman, M., "Report on Full-scale Work", *R & M No 86*, op cit
- 16 Child, S., and Caunter, C.F., op cit p17
- 17 de Havilland, Sir G., *Sky Fever* op cit, p89
- 18 O'Gorman, M., "Report on Full-scale Work", *R & M No 86*, op cit
- 19 "Scout S.E.2 Aeroplane: Experiment to Obtain Data for a High-speed Machine", 1913, The National Archives DSIR 23/273
- 20 Bruce, J.M., "Ancestors of the S.E.5, Part 1", op cit
- 21 de Havilland, Sir G., *Sky Fever* op cit, pp89–90
- 22 O'Gorman, M., "Report on Full-scale Work", *R & M No 86*, op cit, p265
- 23 Ibid, p266
- 24 Ibid, p266
- 25 Ibid, p266
- 26 The National Archives DSIR 23/273, op cit, and Bruce, J.M., "Ancestors of the S.E.5, Part 1", op cit, p351
- 27 Ibid
- 28 O'Gorman, M., "Report on Full-scale Work", *R & M No 86*, op cit
- 29 Bruce, J.M., "Ancestors of the S.E.5, Part 1", op cit, p352
- 30 Ibid, pp351–352
- 31 Ibid, p352
- 32 Bruce, J.M., "Ancestors of the S.E.5, Part 2", *Aeroplane Monthly*, August 1976, p430
- 33 Ibid
- 34 Ibid, pp430–431
- 35 Ibid, p431
- 36 McCudden, J.T.B., *Five Years in the Royal Flying Corps (The Aeroplane & General Publishing, London, 1918)*, pp65–66
- 37 Bruce, J.M., *The Aeroplanes of the Royal Flying Corps Military Wing*, second revised edition (Putnam, London, 1992), p467



In July 1944 Royal Marine **WILLIAM HISCOCK** was serving aboard cruiser *HMS Hawkins* off the Normandy coast when the ship was recalled to the UK for leave. It then sailed for Scotland, where an unusual assignment awaited the ship and its crew . . .



CODENAME HIGHBALL *and me*

IHAD JOINED *HMS Hawkins* in November 1943 in South Africa and, after active service in the Indian Ocean, we sailed back through the Med, dodging U-boats and air raids before returning to Greenock and eventual service off *Omaha* beach on D-Day, where our 7.5in guns were ideal for bombardment. We then did a seven-week stint as a depot ship off Arromanches.

In late July 1944 we left Normandy and called in at Portsmouth before sailing to Rosyth on the Firth of Forth for outstanding leave, after which the ship sailed for the Clyde area, where we were reduced to a skeleton crew, the gun crews and specialists being drafted back to barracks.

The ship was used for various jobs such as testing for trackless torpedoes and steaming around Whiting Bay, off the Isle of Arran, testing the gear of the new fast tankers that were coming off the stocks for use in the Pacific. They pumped fuel into us at 400 tons an hour at 18kt and then sucked it all out again!

ARRIVAL OF THE BOFFINS

I am not sure of the exact date, although it must be in the records, but we were sent to Lamlash and then into Loch Striven under strict security. The port side had vertical lines painted on and the ship was tied to a tree ashore and an anchor in the loch. Six extended arms were put over the side with

microphones in the water, connected to recording apparatus in the centre of the ship. Civilian “boffins” were in charge.

Security ashore was tight: guards kept crofters in their cottages and all forestry workers were removed from the area. We were told that half-ton replicas of the “Dambusters” bomb were to be dropped by de Havilland Mosquito bombers. When the bombing runs took place we were told to get behind partitions on the starboard side of the ship while all upper deck hatches were secured. However, being young and curious, we had a look out of the manholes in the hatches and saw the Mozzie come in at about 300kt and drop the spinning bomb, which bounced along the water several times — but before it hit we had scarpersed!

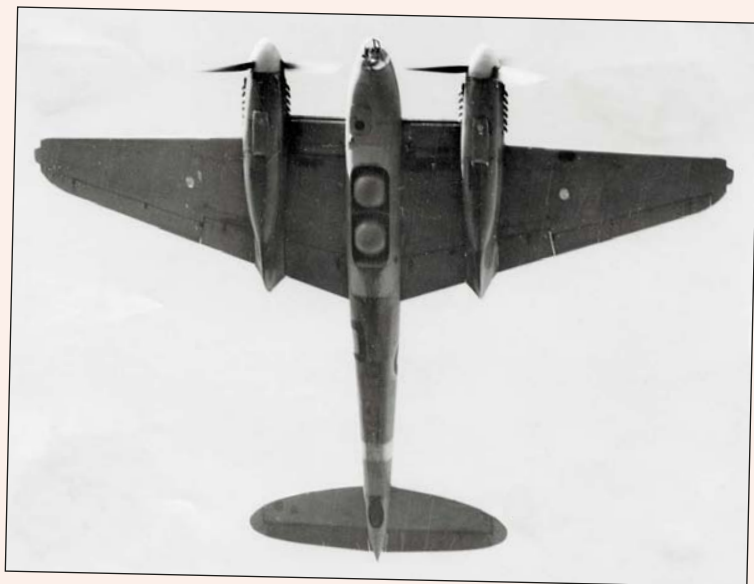
The impact of the weapon on the ship’s side sent rivets flying through adjacent partitions like shrapnel. One weapon hit the porthole of the cabin of the Gunner (T). The shattered pieces shredded the clothes in his wardrobe and lockers and then continued through his door and partition into the Warrant Officer’s flat and into Royal Marine lockers. One Marine, “Sammy” Drinkwater, was asleep on top of the lockers and was unscathed — a testament to the power of Pusser’s Single Malt Rum!

After the trials a piece of plywood was fixed over the hole in the side and painted grey. We

LEFT *de Havilland Mosquito B.IV Series ii DK290/G (the G suffix marking the carriage of secret equipment that had to be guarded at all times) was sent to Heston Aircraft in March 1943 for the trial installation of the Vickers Highball bouncing bomb.*

INSET LEFT *William C.S. Hiscock joined the Local Defence Volunteers in 1940, aged 16, and two years later joined the Royal Marines. He sailed to South Africa in early 1943 to complete training, and later that year was assigned to the Improved Birmingham-class cruiser HMS Hawkins (L86).*

RIGHT *An underside view of DK290/G, clearly showing a pair of Highballs mounted in the bomb bay. The bombs were spun before release, motive power coming from a ram-air turbine fed via an air scoop fitted in the bomb-bay.*



were told to tell people who asked about the damage that we had been hit by one of our own rocket-firing aircraft in error. On one run the aircraft did not drop the bomb and we could see the bomb spinning in the aircraft's bomb bay.

STRICTLY HUSH-HUSH

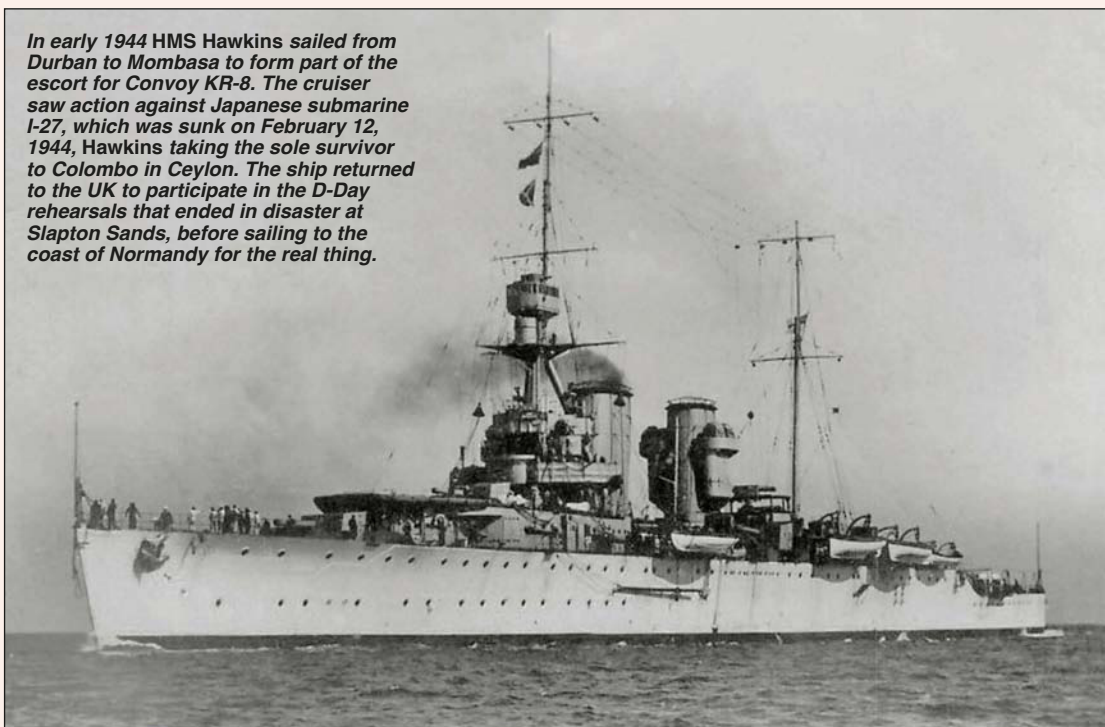
The secrecy of the event was rammed home when a Marine mentioned the trials in a letter home. It was intercepted by Naval Intelligence and he was sentenced to 90 days in cells, later reduced at the request of the Captain to 90 days on board without leave and loss of his good conduct badge.

It was many years before I saw any mention of these trials in books or in the press. I did eventually see a book on the Mosquito; one illustration showed the silhouette of the target, and this was *HMS Hawkins*. We were also told at the time that one of the R-Class battleships, either *Royal Sovereign* or *Resolution*, was also involved in Loch Striven and there is film of *Highballs* hitting the side of a battleship, although I have seen no film of *HMS Hawkins* in these trials.

The general opinion on the mess decks of *HMS Hawkins* after the exercise was that it was a bloody sight safer fighting the Germans!



In early 1944 HMS Hawkins sailed from Durban to Mombasa to form part of the escort for Convoy KR-8. The cruiser saw action against Japanese submarine I-27, which was sunk on February 12, 1944, Hawkins taking the sole survivor to Colombo in Ceylon. The ship returned to the UK to participate in the D-Day rehearsals that ended in disaster at Slapton Sands, before sailing to the coast of Normandy for the real thing.



HOW AMERICA'S LOCAL AIRLINES PUT MAIN STREET ON THE MAP

During the Second World War the American government made one of the most far-sighted decisions in the history of the nation's transport system when it recognised a future need for dedicated local air services.

DAVID H. STRINGER introduces a two-part series on the USA's post-war "feeder airlines" — the vital link between America's small cities and urban centres



EVEN TODAY IN the USA many citizens do not realise that in the 1950s and 1960s the country was blanketed by a group of air carriers which served virtually every nook and cranny of the “Lower 48” states. Residents of smaller cities — Hazleton, Pennsylvania; or Moultrie, Georgia; or Gallup, New Mexico, for example — could board a 21–28-passenger Douglas DC-3 at their hometown airport and be on their way to anywhere in the world. The 13 airlines “permanently certificated” to provide this convenience eventually wound up serving more than 580 cities in the USA with a fleet of more than 400 aircraft.

BIRTH OF THE LOCALS

These “Local Service Airlines”, as they eventually became known, were given birth by the Civil Aeronautics Board (CAB). In 1943 the CAB undertook a mission to investigate the possibility of extending scheduled air service to smaller cities and towns throughout the USA even if the service to some of these communities might not be economically viable. This was an incredibly progressive undertaking for a government agency. The USA was in the middle of World War Two. The nation was becoming “air-minded” and the members of the Board knew that once the war was over every city and town would want to be on the airline map. This new industry was carrying the weight of importance that America’s railroads had shouldered in the 19th Century. Providing trans-

port to isolated towns and air service to communities near military installations in support of national defence were additional reasons for examining the potential of this new type of air carrier.

In order to make routes into smaller cities attractive to airline entrepreneurs, the government proposed offering aid in the form of subsidies for carrying the US air mail. When the war ended, thousands of freshly-trained pilots would be returning to civilian life looking for jobs. Affordable war-surplus aircraft would also become available after hostilities ended. With these three forces at work — subsidy, manpower and affordable aircraft — the seeds were planted and the timing was right.

The Board issued its opinion in summer 1944, stating that this new level of air service should be instituted on an experimental basis. There would be a whole new set of certificated carriers to be called “Feeder Airlines” because their primary purpose would be to take passengers from smaller cities and towns to the big airports where those passengers could be “fed” to the trunk airlines for their onward journeys. By this time there were already hundreds of applications on file for different forms of air service to small cities and towns.

In addition to feeder airline proposals using fixed-wing aircraft, there were helicopter service presentations, plans for mail pick-up service and schemes by companies associated with railways and bus lines for air service to be co-ordinated with their primary businesses. Unsurprisingly, the established trunk airlines were very wary of creating a whole

Strike up the band! — the inauguration of air services to smaller cities in the USA with the DC-3s of the local feeder airlines was cause for celebration. Empire Air Lines DC-3 NC62375, City of La Grande, was one of several used by the Boise, Idaho-based airline, which received its feeder certificate from the CAB in 1946.

JON PROCTOR COLLECTION





ABOVE The ubiquitous Douglas DC-3 became standard equipment for all of the successful local service carriers. Here, a Monarch Air Lines example awaits its passengers. Monarch merged with Challenger Airlines and acquired the certificate of Arizona Airways to form Frontier Airlines in 1950. **BELOW** A pair of DC-3s of Minneapolis-based North Central Airlines, the more appropriate moniker for Wisconsin Central Airlines, which was renamed in late 1952.

new set of airlines when they felt they could handle the feeder service proposal themselves. But the CAB wisely decided that an entirely experimental concept should be undertaken by outfits solely dedicated to providing this new level of service. These feeder airlines had to prove themselves capable and their operations would be scrutinised every few years to determine whether their certificates should be renewed. The Board felt that large carriers concentrating on bigger markets could not be depended upon to offer the kind of service envisioned for smaller, less productive stations.

The process began. Regular CAB hearings scheduled to cover service proposals in specific parts of the country now included applications for feeder air service. Presentations were made for what were called “cases”, oral arguments were heard, proposals examined and recommendations made. After the

latter were studied, awards would be granted by the five-member board (see panel on page 59) and, often, these were followed by appeals and rebuttal arguments. After the process had run its course, many applicants would be eliminated and one company that had shown itself to be particularly “fit, willing and able” to provide feeder service in a particular part of the country walked away with the coveted Certificate of Public Convenience & Necessity. Most of the time the board got it right. It would choose an outfit that could take the concept from drawing board to reality. And America’s Local Service Airline network began to take shape.

THE FIRST FEEDER AIRLINES

The honour of being the first of the certificated feeder carriers to get off of the ground went to Essair, the first three letters standing for “Efficiency,

“Unsurprisingly, the established trunk airlines were wary of creating a whole new set of airlines when they felt they could handle the feeder service themselves”



A glorious colour photograph of Wisconsin Central DC-3s N12978 (nearest) and N26214 on the busy ramp at Chicago's Midway Airport in 1952. In the background, trunk carrier airliners are prepared for another flight, including a pair of American Airlines DC-6s, beyond which is a Capital Airlines DC-4. The local airlines were initially called feeders as their objective was to "feed" small-town traffic to the trunk airlines.

BOB PROCTOR VIA JON PROCTOR COLLECTION





ABOVE *Echoes of the dust bowl — this rare photograph shows a Central Airlines Beechcraft A-35 Bonanza at Woodward, Oklahoma. The type was woefully inadequate for commercial service but a fleet of 11 Bonanzas allowed Central to take to the air in September 1949. By June 1951 Central had completed the transition to an all-DC-3 fleet.*

Safety and Speed". The company had been in existence for several years and had previously provided intrastate service within Texas for a brief period. On August 25, 1945, Essair began service under its new feeder certificate, operating between Houston and Amarillo, Texas, via four intermediate stops using Lockheed L-10A Electras.

The following year DC-3s were introduced to replace the Electras and the company management wisely changed the outfit's name to Pioneer Air Lines. Pioneer would become the first of the local service carriers to operate an aircraft larger than the DC-3 when it replaced its fleet of Gooney Birds with Martin 2-0-2s in 1952. Unfortunately for Pioneer, the upgrade to Martins without permission did not sit well with the CAB and the company was eventually forced to reinstate an all-DC-3 operation. Pioneer reintroduced the 2-0-2 into its fleet before finally succumbing to a merger with Continental Air Lines in April 1955. By that time Pioneer was serving 21 stations in Texas and New Mexico.

In the Rocky Mountain States Case, decided in March 1946, Ray Wilson Inc, an applicant from Denver, Colorado, was awarded routes from Denver and Salt Lake City south to Albuquerque via intermediate stops. By the time the company inaugurated service in November of that year it had become Monarch Airlines. Since Essair had already operated intrastate services before receiving its certificate, Monarch is considered by some to be the first feeder airline created from scratch to become airborne. In the same Rocky Mountain States Case, Summit Airways was chosen to operate from a northern terminus of Billings, Montana, southward to Salt

Lake City, Utah, and Denver, Colorado, via intermediate points. By the time Summit began operations in the spring of 1947, it had rechristened itself Challenger Airlines. Monarch and Challenger would eventually merge and absorb the certificate of yet another feeder, Arizona Airways, in 1950. The amalgamated enterprise would proudly call itself Frontier Airlines.



Florida Airways, originally called Orlando Airlines, was awarded routes as part of the CAB's Florida Case, which was decided in March 1946. Florida operated Beechcraft D-18s to ten airports in northern Florida on routes stretching from Orlando to Jacksonville and Tallahassee. Service was planned as far south as Miami and as far west as Pensacola. But Florida Airways would go out of business in 1949.

Empire Air Lines, formerly known as Zimmerly Air Lines, was already operating in Idaho when it received its certificate on May 22, 1946, to operate from Idaho Falls, Idaho, to Spokane, Washington, via a string of intermediate cities. Empire operated Boeing 247Ds, eventually replacing them with five DC-3s. Empire would merge with West Coast Airlines in 1952, the name of the latter being kept.

THE WEST COAST CASE

In the CAB's West Coast Case, also heard in 1946, two more feeders received their certificates: Leland Hayward's Southwest Airways was awarded a system that stretched from Los Angeles northward through many cities in California to Medford, Oregon. Nick Bez's West Coast Airlines received authority to operate from northernmost Washington State (Bellingham) southward to Medford,



ABOVE Nick Bez, founder and President of Seattle-based West Coast Airlines, was an immigrant from Croatia and typical of the industry's self-made men.

where it met up with Southwest. Both airlines began service in December of 1946. Southwest Airways would change its name to Pacific Air Lines in 1958.

By the end of May 1947 seven feeder airlines were operating under their new CAB certificates: Challenger, Empire, Florida, Monarch, Pioneer, Southwest and West Coast. Two airlines, Bonanza and Robinson, were conducting intrastate operations, in Nevada and New York State respectively, but both would be operating under full CAB feeder certificates before long. One more company, All American Aviation, was flying airmail and express only on a unique air "pick up" system in the Mid-Atlantic states. The company would eventually

The CAB five-member board

BEFORE AIRLINE DEREGULATION in the USA in 1978, the Civil Aeronautics Board (CAB) oversaw the nation's airline system, awarding routes, denying route applications, controlling competition and overseeing other administration duties. The CAB was always made up of five members — an odd number — so that there would never be a tie when the members voted.

The members of the Board were political appointees and they changed many times over the years. The five-member Board served in an almost judicial role, deciding on route applications, fare prices, subsidies etc. If three members voted "yes" on an award and two against, it was passed. Conversely, if two voted in favour of an airline's application and three voted against, the application was denied.

The five-member Board was provided with a staff, like any other government agency. The "grunt work" was done by examiners who would study applications, examine the need for an air service to affected communities or over certain routes, and then report back with a recommendation. The Board would study the examiner's findings and agree or disagree, in whole or in part, with those findings. The CAB built the system, keeping trunks separated from locals, regulating all-cargo carriers and limiting the operations of the supplemental airlines.

Under today's deregulated system airlines are free to operate wherever profitable. If an airline serves a city for two months and finds it unprofitable, they are free to pull out. In the days of the CAB an airline was certificated to serve a point until the CAB gave permission to stop.

Allegheny Airlines DC-3 N91228 arrives on the ramp at the airport serving Parkersburg, West Virginia, and Marietta, Ohio. Allegheny was originally known as All American Airways, changing its name in 1953, the airline going on to become USAir in 1979 and US Airways in 1996. The merger of the latter with American Airlines in 2013 will see the last direct descendant of the original Local Service Airlines disappear.





An Ozark Air Lines DC-3 over Springfield, Illinois, in 1951. Ozark owed its existence to the failure of another feeder, Parks Air Lines (Parks Air Transport). The CAB cancelled the Parks certificate and awarded the bulk of its routes to Ozark, the last of the 13 permanently-certificated locals to receive its certificate. R. DEAN DENTON

The CAB's first 25: 1945–50

LISTED BELOW ARE the 25 feeder airline certificates issued by the CAB during 1945–50:

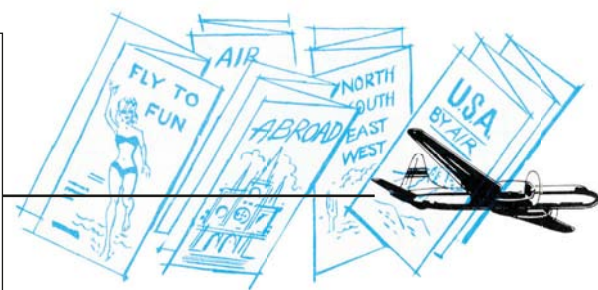
- Air Commuting
- All American Airways
- Arizona Airways
- Bonanza Air Lines
- Central Airlines
- Challenger Airlines (formerly Summit Airways)
- Empire Air Lines (formerly Zimmerly Airlines)
- Essair
- Florida Airways (formerly Thomas E. Gordon & Orlando Airlines)
- Island Air Ferries
- Mid-West Airlines (formerly Iowa Airplane Co)
- Monarch Airlines (formerly Ray Wilson Inc)
- Ozark Air Lines
- Parks Air Transport
- Piedmont Airlines
- Purdue Aeronautics Corp
- Robinson Airlines
- Southern Airways
- Southwest Airways
- Trans-Texas Airways (formerly Aviation Enterprises Inc)
- Turner Airlines (formerly Roscoe Turner Aeronautical Corp)
- West Coast Airlines
- Wiggins Airways (officially E.W. Wiggins Airways)
- Wisconsin Central Airlines
- Yellow Cab Company of Cleveland

abandon this type of operation for a fully-fledged passenger, mail and express feeder certificate as All American Airways, ultimately to be renamed Allegheny Airlines.

THE FIRST 25

Between 1945 and 1950, 25 airlines were issued Certificates of Public Convenience & Necessity to operate as feeders. Hundreds more were rejected in their bids for certification. The term “feeder” was losing favour as the definition of this new type of air carrier was evolving. Not only was their purpose to feed passengers to the trunk airlines — the new carriers were expected to connect big cities with the smaller cities and towns within their market sphere of interest, allowing a person to travel from the big city to the small city in the morning, conduct business, then return home later the same day. Scope for traffic in the opposite direction was also to be provided by these airlines; a person could leave their small city residence in the morning, fly to the big city, conduct business or shop, then return home late that same afternoon or evening.

To provide this level of service a minimum of two round-trips per day over each route would be necessary, one outbound from the big city, or “hub” airport, in the morning, another in the late afternoon or evening and one inbound in the morning, another later in the day. The ideal route would have big city airports at both ends with smaller cities linked along the route between the two like a chain.



“A new type of air carrier was evolving . . . the ideal route would have big city airports at both ends with smaller cities linked along the route between the two like a chain”

That way flights proceeding in both directions would have a large terminal city at either end to serve as a destination and as a transfer point for passengers connecting to trunk airline flights. The title Local Service Airline conveyed this concept better than the moniker Feeder Airline and it became the standard term for these new companies.

THE CONCEPT COMES OF AGE

The feeder airline concept was an experimental proposition and the CAB exercised tight control over the rules of what these carriers could and could not do. The Board’s goal was not only to

protect, nurture and grow the new Locals but also to protect the interests of the trunk airlines, ensuring that they would not suffer undue competition from this new breed. When the Board announced its approval of the feeder concept in 1944, it issued guidelines for certification of the new carriers. Each certificate would state specifically what a company was permitted to do with regard to non-stop or skip-stop service. And even though only the companies that were meticulously scrutinised and found to be the most “fit, willing and able” were selected to perform the new service, their certificates were subject to renewal after three

TOP A Pioneer Air Lines ticket desk circa 1947. Pioneer received the first CAB feeder certificate in August 1945 while trading as Essair.
BELOW Bonanza Air Lines DC-3 N491 at San Diego, California, in May 1959. The airline’s distinctive livery of this period incorporated a vivid orange fuselage band and fin. JON PROCTOR COLLECTION



years, following yet another meticulous review of their operations. Everything about the feeder airline concept was “temporary” and “experimental”.

By 1955 the original 25 certificated companies had been whittled down. Of the 25, five had never become airborne under the terms of their certificates — Air Commuting, Arizona, Island Air Ferries, Purdue Aeronautics and the proposed helicopter operations of the Yellow Cab Co of Cleveland — and three more had their certificates cancelled by the CAB after their first three-year review (Florida, Mid-West and E.W. Wiggins). Two mergers between two different sets of Locals (West Coast/Empire and Monarch/Challenger) had reduced the number of operating certificates by another two and one, Parks, had its certificate revoked after a lengthy investigation during which it tried to establish service. One more, Pioneer, merged with, and was absorbed by, a trunk carrier, Continental Air Lines.

LUCKY FOR SOME: THE FINAL 13

That left 13 relatively strong operating companies in business as of May 19, 1955. Each operated in their own territory and, together, did a good job of covering most of the continental USA. On the date mentioned above, President Dwight D. Eisenhower signed legislation which gave permanent certification to the 13 remaining Local Service Carriers. No longer would their certificates come up for renewal every three to five years. With assurance from the government that these airlines would be around for a while, they now became much more attractive to financiers. They became stable investments instead of risky ventures.

Each of these 13 carriers became familiar to the residents of the territory in which they operated.

The final 13 local carriers

IN 1955 the CAB granted permanent certificates for the following 13 local service carriers:

- Allegheny Airlines (formerly All American Airways)
- Bonanza Air Lines
- Central Airlines
- Frontier Airlines (formerly Arizona Airways, Challenger Airlines and Monarch Air Lines)
- Lake Central Airlines (formerly Turner Airlines)
- Mohawk Airlines (formerly Robinson Airlines)
- North Central Airlines (formerly Wisconsin Central Airlines)
- Ozark Airlines
- Piedmont Airlines
- Southern Airways
- Southwest Airways (later Pacific Air Lines)
- Trans-Texas Airways
- West Coast Airlines

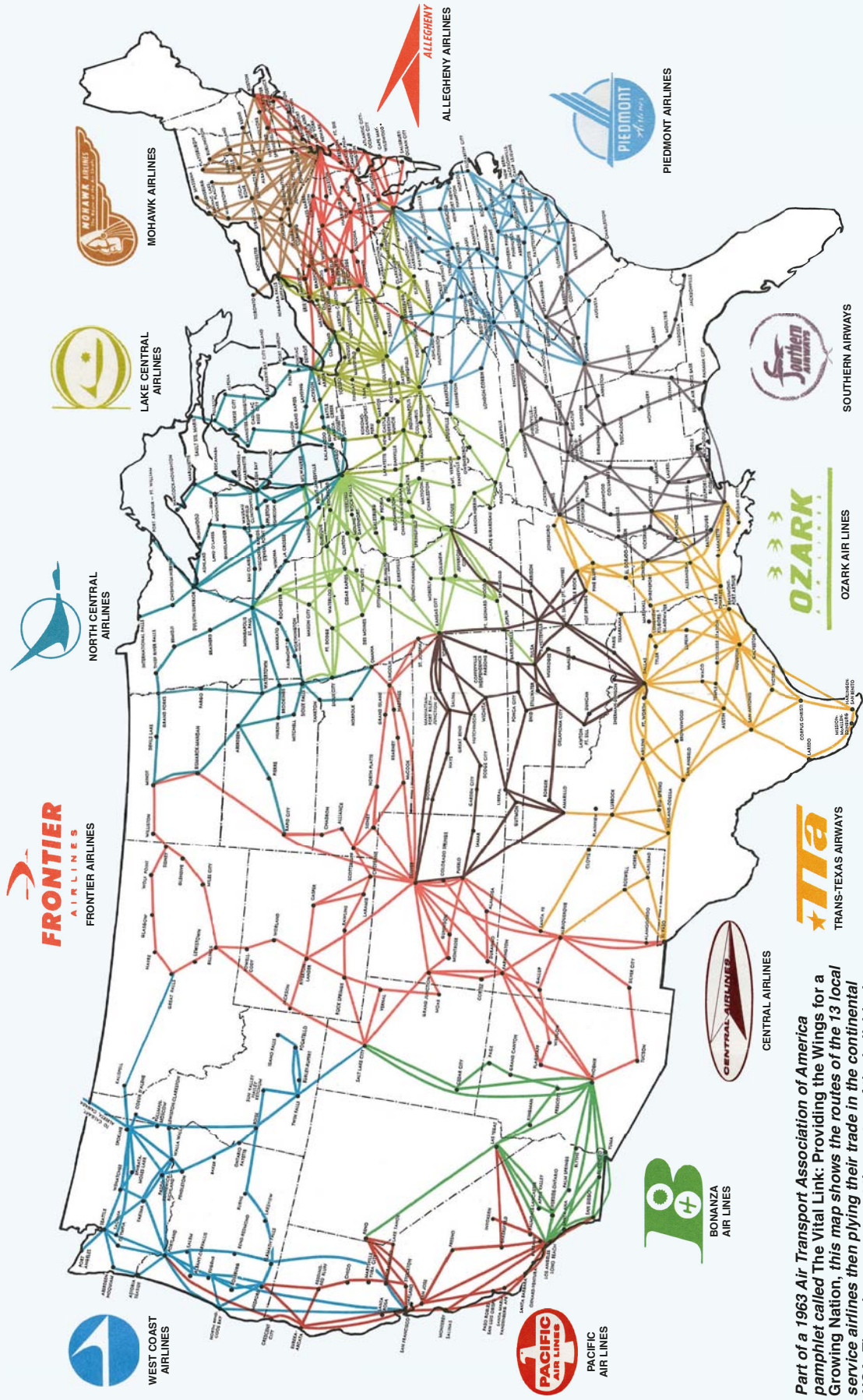
These were their hometown airlines. Because of the regular and reliable schedules that the local airlines offered to the communities they served, businesses and industries were more willing to establish offices and locate manufacturing plants in smaller cities. The Local Service Airlines connected “Main Street USA” to the rest of the world and gave many of the small cities and towns on their networks better inter-city commercial transportation than they would ever see again.



NEXT TIME — The expansion, transformation and demise of the USA's Local Airline Service carriers

Convair 440 Metropolitan N4407 of Mohawk Airlines at JFK Airport, New York, in 1965. Unusually for a local airline, Mohawk acquired its 440s factory-fresh from the manufacturer when it bought examples that had been built “on spec” for other airlines. GRAHAM SKILLEN





Part of a 1963 Air Transport Association of America pamphlet called The Vital Link: Providing the Wings for a Growing Nation, this map shows the routes of the 13 local service airlines then playing their trade in the continental USA. The colours represent the routes of the individual airlines, whose logos correspond to the relevant routes.



THE ULTIMATE WAR PRIZE

GERMANY'S JET ENGINES IN RUSSIA



*Although the Soviet Union had started developing jet engines of its own in the 1930s, the capture of German jet-powered aircraft and their powerplants at the end of World War Two gave Russian engineers the chance to absorb and improve on Germany's advanced jet technology, as **VLADIMIR KOTELNIKOV** explains*

RUSSIA HAS ALWAYS viewed Germany's aero-engine manufacturers with profound respect. Indeed, many of the earliest Russian aeroplanes were fitted with German engines. Igor Sikorsky's *Russkiy Vityaz*, predecessor of the famous *Ilya Muromets* bomber, for example, was powered by Argus engines. During the First World War Russia repeatedly attempted to copy German water-cooled engines. The Russian RBVZ-6 six-cylinder engine, a slightly modified version of the Benz engine,

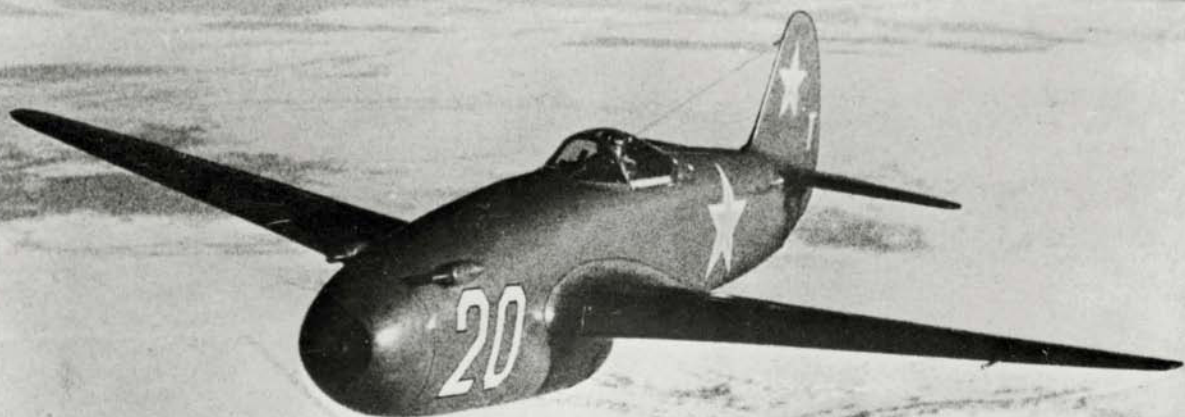
may be considered a successful example of this.

The M-17 powerplant, a Soviet version of the BMW VI liquid-cooled piston engine, was the most widespread engine in service with the V-VS RKKA (*Voenno Vozdushnye Sily Raboche-Krestyanskoy Krasnoy Armii* — Air Force of the Workers' and Peasants' Red Army) in the early 1930s. The M-17, mass produced at a factory in Rybinsk, was used to power Tupolev's TB-1 and TB-3 bombers and ANT-7/R-6 escort ("cruiser") aircraft, Polikarpov's R-5 reconnaissance biplane

TOP A captured Junkers Jumo 004 which was studied at the NII-1 Scientific Research Institute. In March 1945 it was completely dismantled.

BELOW The dividend of war — the Jumo 004-powered Messerschmitt Me 262 was Germany's first operational jet aircraft and captured examples yielded much valuable information for the Allies — including the Soviet Union.





PHILIP JARRETT COLLECTION

ABOVE Based on the Yakovlev Yak-3 fighter, the Yak-15 was one of only two jet aircraft directly based on a piston-engined fighter to go into production — the other was Sweden's Saab J21R. **INSET BELOW** Arkhip Mikhailovich Lyulka was born in Ukraine in 1908 and went on to become one of Russia's most important powerplant designers.

and many other aircraft, as well as tanks. This German influence on the Soviet aero-engine industry decreased considerably in the mid-1930s, however, with the acquisition of production licences from companies in the USA and France. These licence-built piston engines would go on to account for the lion's share of all powerplants delivered to the V-VS during the Second World War.

THE NEW TECHNOLOGY

German influence on the Soviet aero-engine industry was to be revived with the introduction of jet engine technology. The Soviet Union had started developing its own jet engines before the Second World War, the first homegrown design of a turbojet being developed by A.M. Lyulka at the Kharkov Aviation Institute (KhAI) in 1937. This was the RTD-1 (*Raketniy Turboreaktivniy Dvigatel* — rocket turbojet engine) with a centrifugal-flow compressor, and which was capable of 500kg (1,100lb) static thrust. The Kharkov Aviation Institute also initiated preliminary studies for the KhAI-2 fighter, which was to be powered by the RTD-1 engine.

In 1938 Lyulka was transferred to the SKB-1 Design Bureau of the Kirovskiy Factory in Leningrad (now St Petersburg), where he worked on his fully-fledged design for the RD-1 engine (not to be confused with the ZhRD liquid-state-fuel jet of the same designation) with an axial-flow compressor

and capable of 525kg (1,157lb) static thrust. The RD-1 was expected to have undergone bench tests by the turn of 1941.

Turbojet development, which was not considered to be of paramount importance, was suspended when Nazi Germany attacked the Soviet Union on June 22, 1941. The immediate priority was the stepping-up of mass-production of piston engines. However, by late February 1942 V-VS chiefs had started insisting that jet engine development be resumed, and six months later Lyulka and his team of engineers resumed work on the turbojet. Lyulka's team, however, comprised only 15 engineers, scarcely enough to solve the myriad complex problems encountered during jet engine development.

Meanwhile elsewhere the Germans, and later the British, had put jet-powered aircraft into service. As the existence of enemy jet aircraft became increasingly well-known in the Soviet Union, and as information was received that the UK and USA — then allies of the Soviet Union — were also developing jet engines and aircraft, the Soviet authorities took steps to bridge the technology gap. In February 1944 the GKO (*Gosudarstvenniy Komitet Oborony* — State Defence Committee) ordered the establishment of the NII-1 Scientific Research Institute, at which teams of designers would be set to work on various types of jet engine. On May 22, 1944, the GKO





issued two decrees, *On Developing Jet Engines* and *On Developing Jet Aircraft*, both of which envisioned the development of native designs. The Soviet authorities were also determined to investigate the considerable progress made in the field of jet technology by the Germans as and when the opportunity arose.

CAPTURED HARDWARE

By the end of the Great Patriotic War — as the Second World War is referred to in Russia — Soviet troops had captured a number of German jet aircraft, the engines that powered them and even entire aircraft and engine factories. The Special Chief Directorate of the NKAP (*Narodniy Komissariat Aviatsionnoy Promyshlennosti* — People's Commissariat of Aviation Industry), tasked with searching for equipment and materiel to be taken to the USSR, began operations in Germany in March 1945, part of these operations including searching for jet aircraft and engines. Initially the NKAP's objective was to find individual turbojet units and their documentation and have them sent to the Soviet Union. In the early stages, the NKAP found a total of 13 turbojet engines,

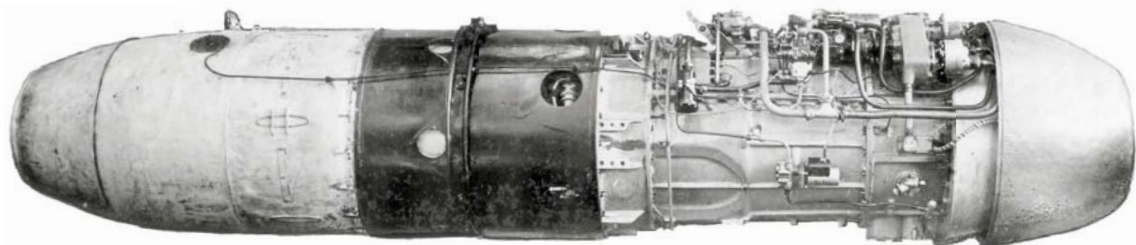
including five BMW 003s suitable for studying, at various Heinkel factories.

In the summer of 1945 the GKO issued another decree; *On Measures Aimed at Studying and Mastering German Jet Aircraft*, which covered the studying of the results of scientific research into turbojets in Germany, the testing of captured jet aircraft and the copying and production of Jumo 004 and BMW 003A jet engines.

Accordingly, Jumo 004, BMW 003A and Heinkel S 8a engines, delivered from Germany, underwent bench tests at NII-1 and the TsIAM (*Tsentralniy Institut Aviatsionnogo Motorostroeniya* — Central Institute of Aircraft Engine-Building) as early as August 1945. A total of 39 Jumo 004s, three BMW 003As and two Heinkel S 8a engines (although not all were in serviceable condition) as well as a number of engines mounted on aircraft had been sent to the Soviet Union by the end of 1945. The Jumo 004 engines had been assembled at the captured underground factory outside Dessau from available parts and assemblies.

Comparison tests of the Jumo 004 and Lyulka's S-18 turbojet prototype were conducted in 1946, the Soviet-built engine proving to be more efficient

The RD-10 was developed from the Jumo 004 and put into production at Ufa. The engine was used to power several of the Soviet Union's first-generation jets, including Sukhoi's Su-9 (not to be confused with the later 1950s delta fighter of the same designation). PHOTOGRAPHS VIA AUTHOR UNLESS OTHERWISE STATED



LEFT An American soldier clammers over a disconsolate Me 262 at a captured Luftwaffe airfield. As the Allies closed in on Germany in the last months of the war, the race to capture and evaluate German technology was on between the Soviet Union and its notional "allies", the prize being Germany's advanced scientific know-how.



RIGHT Students at the Moscow Aviation Institute's Faculty of Aircraft Engine Design study one of the Junkers Jumo 004s captured by the Russians, during a course in 1949.

and with a superior thrust-to-weight ratio. However, it was considerably inferior to the German engine in terms of reliability. The latter had already seen service while the S-18 was not yet suitable for powering aircraft. The service life of the S-18 was limited to a matter of hours owing to the inferior contemporary methods of Soviet metallurgy — there were no heat-resistant alloys from which to manufacture turbine blades. To overcome this, billets of Tinidur steel alloy were later imported from Germany, before the Soviets eventually smelted an (inferior) copy of Tinidur.

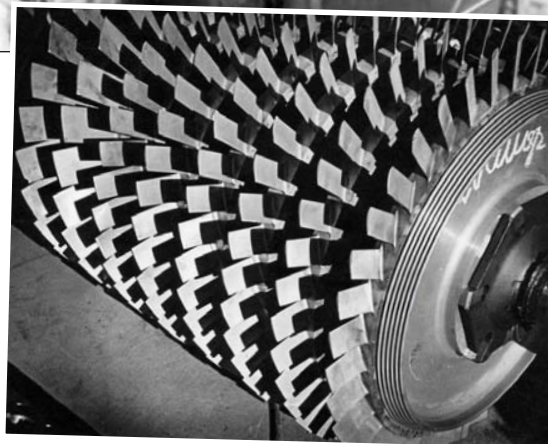
INTO PRODUCTION

The Jumo 004 engine was put into production at Factory No 26 in Ufa in south-eastern Russia. Production of the engine, designated RD-10, was supervised by Vladimir Ya. Klimov, assisted by engine designer Nikolai D. Kuznetsov and Ferdinand Brandner, former technical director of the Junkers factory in Dessau, who had been released from prison specifically to assist with the Soviet jet engine programme.

It was planned that some 110 RD-10s be manufactured by the end of 1945, but delays caused by the need to convert captured German documentation into the Soviet system of tolerances slowed the process down and only a few dozen turbojets had been manufactured by early 1946. The first engines incorporated a great number of parts and assemblies imported from Germany. In total, some 59 RD-10s were manufactured in 1946, the numbers rising to 447 in 1947 and 833 in 1948.

Brandner and Kuznetsov would go on to design the RD-12 engine of 3,000kg (6,615lb) static thrust. This engine was built and bench-tested but a blade broke during a start-up, and several designers were injured by debris in the resulting explosion. Development of the RD-12 was cancelled in late 1948.

The BMW 003A was put into production at



ABOVE The eight-stage axial compressor of a Jumo 004 captured by the Americans. In contrast, the BMW 003 was fitted with a seven-stage axial compressor.

RD-10/RD-20 ENGINE DATA

BASED ON THE German Junkers Jumo 004 turbojet, the **RD-10** comprised an eight-stage axial compressor and a single-stage turbine

Thrust	900kg	(1,984lb)
Specific fuel consumption*	1.43kg/kg.hr	1.43lb/lb.hr
Dry weight	720kg	(1,587lb)
Length	3.935m	(12ft 11in)
Diameter	0.810m	(2ft 8in)

The **RD-20** was essentially a Soviet-built variant of the BMW 003 axial-flow turbojet with a seven-stage axial compressor and a single-stage axial turbine

Thrust	800kg	(1,764lb)
Specific fuel consumption*	1.4kg/kg.hr	1.4lb/lb.hr
Dry weight	660kg	(1,455lb)
Length	3.64m	(11ft 11½in)
Diameter	0.68m	(2ft 3in)

* Specific fuel consumption is a measure of powerplant efficiency — it is the fuel consumption divided by the thrust



ABOVE An early production Yak-15 built at Factory No 31 at Tbilisi, Georgia. These examples were not armed as they were intended to serve only as transition trainers to acclimatise pilots to jet technology.

RIGHT The snug installation of the RD-10 in the Yak-15, in this case an early production example. The engines for these were assembled at Factory No 26 at Ufa from parts manufactured in Germany.



Factory No 16 in Kazan (now the capital of Tatarstan in south-eastern Russia) under the supervision of chief designer S.D. Kolosov. Unfortunately for the Soviets, the Americans had cleaned out the underground factory in Strassfurt in the Soviet occupation zone, taking away all the assembled jet engines and their documentation. Nevertheless, Soviet engineers managed to reverse-engineer the engine by using captured samples found elsewhere and scattered drawings. In late 1945 the Kazan factory assembled several examples of the RD-20, the designation given to exact copies of the BMW 003A, but this engine was considerably less popular than the RD-10.

The German engines were progressively modernised by Soviet designers as production continued. The 800kg (1,765lb)-thrust RD-20 was refined into the 1,000kg (2,205lb)-thrust RD-20F, which was developed into the 1,050kg (2,315lb)-thrust RD-21, which incorporated a modified combustion

chamber, turbine and nozzle, and was put into series production. The Jumo-based 910kg (2,006lb)-thrust RD-10 was followed by the RD-10A of similar thrust but with an extended service life, from which was developed the 1,100kg (2,425lb)-thrust RD-10F which incorporated an afterburner.

Putting jet engines into production was a good start, but was only the first step — they now had to be mounted in aircraft. The logical conclusion appeared to be to manufacture German-designed fighters and bombers, as serviceable examples, factory documentation and specialists capable of manufacturing them were readily available. Captured Luftwaffe pilots and mechanics were on hand to help Soviet pilots master the new aircraft.

NEW HOMEGROWN AIRFRAMES

The Soviet authorities discussed producing versions of the Messerschmitt Me 262 fighter and Arado Ar 234 bomber. However, after studying

Showing its piston-engined fighter heritage, the Yak-15 was developed quickly in order to capitalise on the production of the new series of jet engines being produced by the Soviet Union. This example was photographed during State testing of the type.



The Mikoyan-Gurevich design bureau decided on a very different approach from that of Yakovlev for its first jet fighter, twin BMW 003 engines (later RD-20s) being mounted side by side within the fuselage. Seen here is the prototype I-300, which evolved into the MiG-9.



“TRIALS REVEALED THAT EACH FIGHTER HAD ITS OWN ADVANTAGES — THE YAK-15 WAS MORE MANŒUVRABLE BUT THE MIG-9 COULD CARRY HEAVIER ARMAMENT . . .”

extensive information on their disadvantages, senior officials decided to order the design and construction of indigenous jet aircraft. The Yakovlev and Mikoyan-Gurevich (MiG) design bureaux were the first to start developing such aircraft, the former gambling on being able to prepare a prototype quickly by using the latest version of the Yak-3 piston-engined fighter as a basis. The wing, rear fuselage, cockpit and tail unit of the new jet would be a straight graft from the Yak-3. The new machine, designated Yak-15, would also be fitted with the Yak-3's taildragger undercarriage, although the tailwheel would be fitted with a tyreless steel rim, as it was felt that the RD-10 engine's jetwash, which streamed under the fuselage, would melt the tyre.

MiG, on the other hand, designed a brand new aircraft, designated I-300 (later MiG-9). The initial design, completed in 1945, envisioned mounting two BMW 003 jet engines under wing panels, but

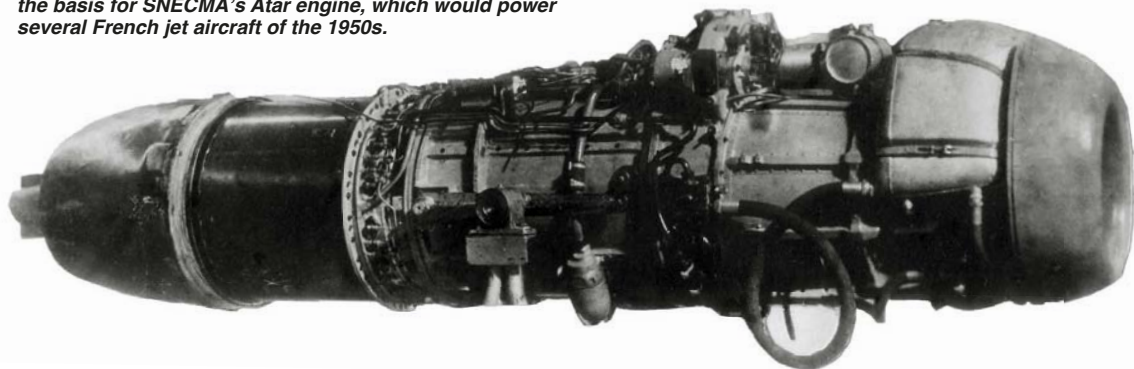
after consideration MiG's designers adopted the stepped layout similar to that of the Yak-15 and accommodated the two engines side by side inside the fuselage. The undercarriage was of modern tricycle design.

The Soviet Government had ordered both design bureaux to develop their new jet aircraft within a very short timeframe, and both rose to the challenge. The Yak-15 and MiG-9 made their maiden flights at Zhukovskii on the same day — April 24, 1946. The Mikoyan team pipped Yakovlev to the post when a coin was flipped and test pilot A.N. "Lesha" Grinchik took off in the MiG-9. Three hours later Mikhail Ivanov took to the air in the Yak-15.

Trials revealed that each fighter had its own distinctive advantages. The Yak-15 was more manoeuvrable, had a better rate of climb and was of simpler design. The MiG-9, however, could carry heavier armament — a 37mm cannon and

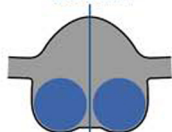
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The RD-20, based on the BMW 003, had a slightly smaller diameter than the RD-10, and was marginally less powerful. The RD-20 was put into production at Kazan and later became the basis for SNECMA's Atar engine, which would power several French jet aircraft of the 1950s.



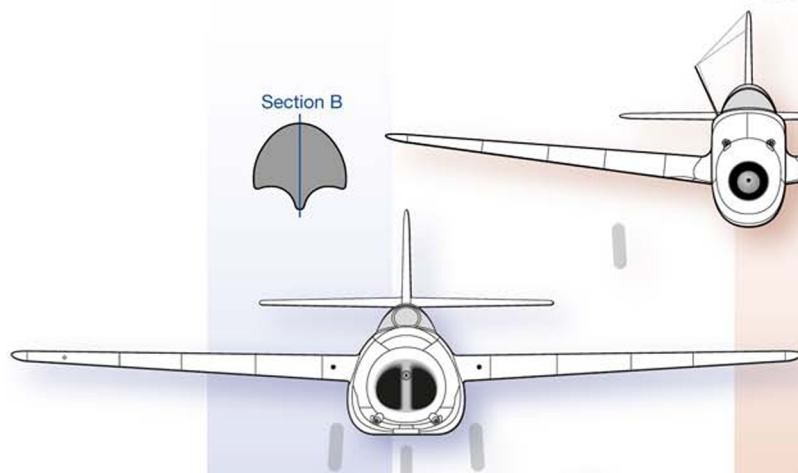
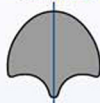
Mikoyan-Gurevich MiG-9

Section A



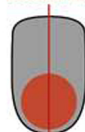
Two RD-20 engines

Section B

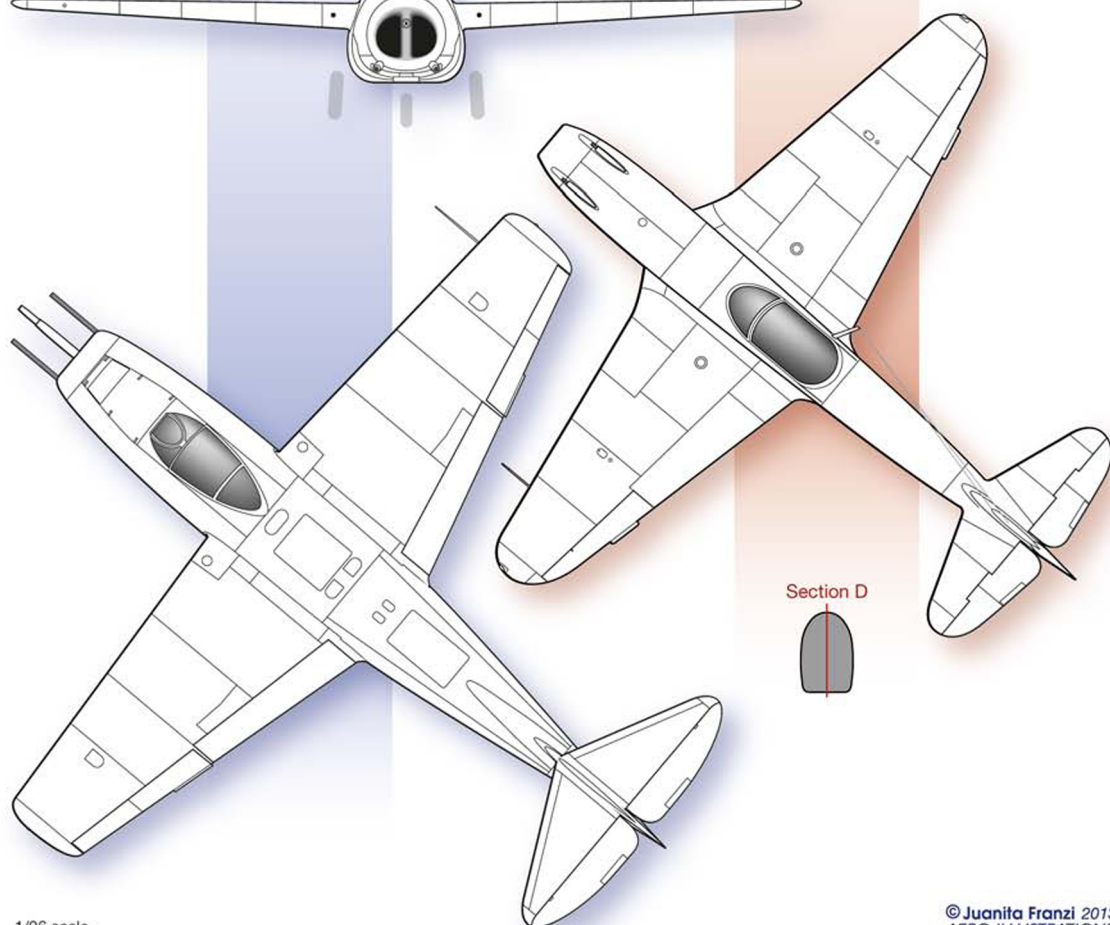
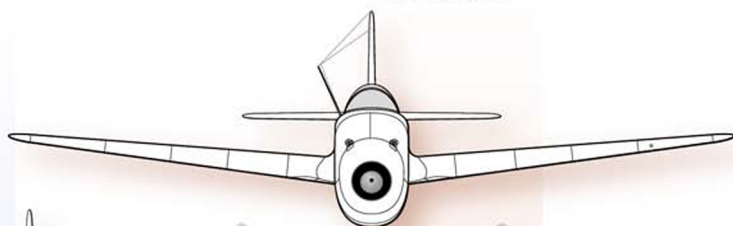


Yakovlev Yak-15

Section C



Single
RD-10 engine



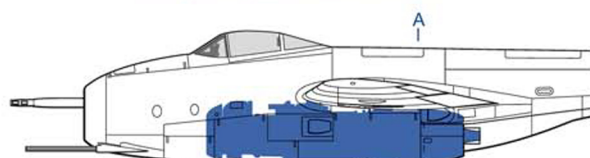
Section D



1/96 scale

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AERO ILLUSTRATIONS

Mikoyan-Gurevich MiG-9

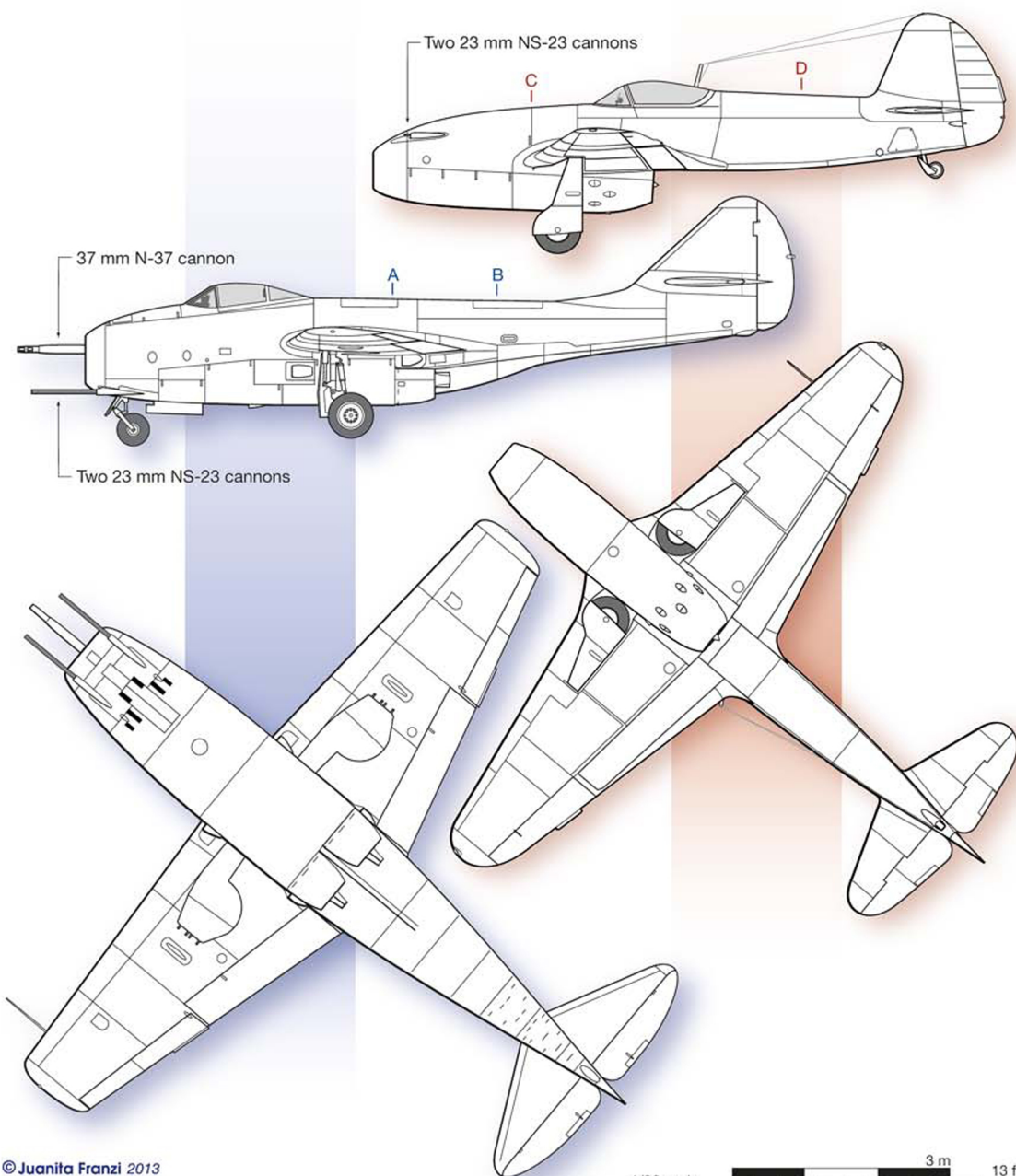


RD-20 engine installation

Yakovlev Yak-15



RD-10 engine installation





ABOVE A production MiG-9, fitted with a pair of RD-21s, in May 1947. When Nato was formed in April 1949 the aircraft was allocated the reporting name Fargo. The Yak-15 was similarly given the reporting name Feather.
BELOW A sectioned RD-10 engine at the Moscow Aviation Institute (MAI) in 1950. The MAI was one of the largest and most important technical schools in the Soviet Union, and most of Russia's top engineers studied there.

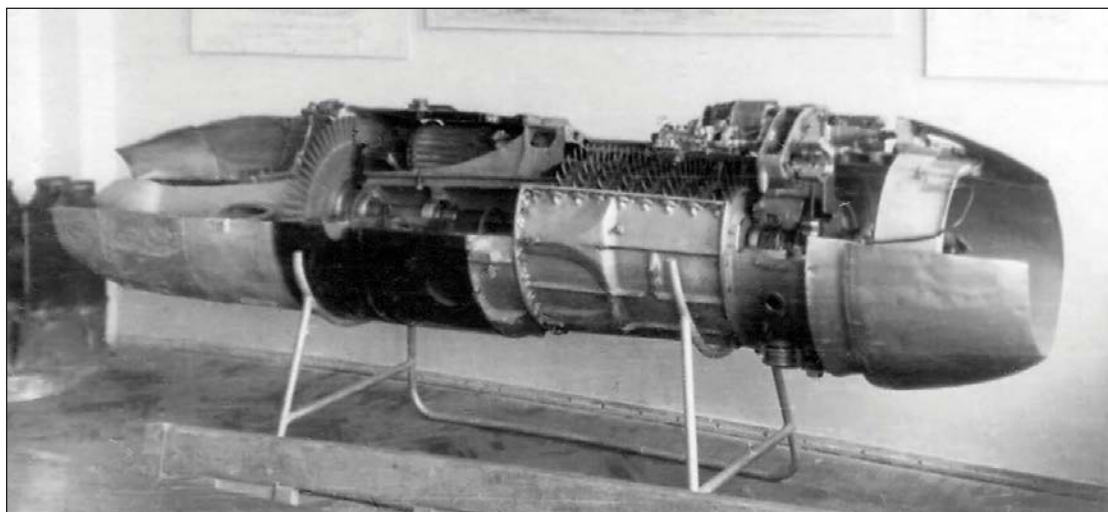
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two 23mm cannon, while the Yak-15 was equipped with two 23mm cannon only. The MiG had a greater combat speed — it was 70–80km/h (44–50 m.p.h.) faster than the Me 262, while the Yak-15 was 70–80km/h slower than the German fighter — and a greater acceleration in the dive. Once initial tests had been completed, the authorities decided to put both aircraft into series production.

Unsurprisingly, production of the simpler Yak-15 was mastered more quickly and the first series production aircraft were delivered as early as October 1946. MiG-9s began rolling off the assembly lines in April 1947, powered by the refined RD-21 rather than the RD-20. Some 280 Yak-15s and 604 MiG-9s

were built. The Yak-15 was succeeded by the Yak-17, fitted with a tricycle undercarriage. Yakovlev also installed the RD-10 on the Yak-21 trainer, essentially a two-seat version of the Yak-15. The RD-10F powered the Yak-19 prototype, on which the stepped layout was replaced by a straight-through configuration with the turbojet accommodated inside the fuselage behind the cockpit.

The RD-10 also powered other fighter prototypes, including Pavel Sukhoi's Su-9, which had an RD-10 under each wing, similar to the layout of the Me 262. Syemyen Lavochkin also designed several RD-10-powered prototypes including the La-150, -150M, -150F, -152, -154, -156, and -160.



Blueprints and RD-10A prototypes were also transferred to Poland, series production getting under way at Mielec under the local designation G-2 in 1949. These examples were fitted to the Yak-17V fighters produced in Poland.

DEVELOPING MORE POWER

So far, so good — but the Soviet Union was not satisfied with merely copying the wartime achievements of German designers. Soviet engineers were rightly convinced that they could go further and build more powerful and reliable turbojets. German specialists actively participated in establishing jet aviation in the Soviet Union, the Kremlin adopting a policy regarding their employment to this end in the summer of 1945. The Soviet authorities slowed down the dismantling of equipment at large factories, design bureaux and scientific research institutes in Germany. Scientists, engineers and workers were hired in various ways. Some handed themselves in to the authorities, some were hired and provided with wages and food rations while others were forced to co-operate. Prisoner-of-war camps were scoured for jet engine specialists.

These German specialists were assigned to the OTB (*Osoboe Tekhnicheskoe Byuro* — Special Technical Bureau), later renamed OKB (*Osoboe Konstruktorskoe Byuro* — Special Design Bureau). Such bureaux were financed partly with assets — German Marks — captured in German factories' payment offices. Branches of the OKB had been set up by March 1946 and in April they began to receive specific tasks. For instance, the OKB-1 engine department in Dessau was ordered to prepare the modified 1,200kg (2,645lb)-thrust Jumo 004F by May 1946 and submit the 3,000kg (6,615lb)-thrust Jumo 012 turbojet for bench tests in August. The OKB-2 in Strassfurt was ordered to start testing the upgraded 1,050kg (2,315lb)-thrust BMW 003C

MiG-9/YAK-15 DATA

Mikoyan-Gurevich MiG-9 (I-300)

Powerplant 2 x 800kg (1,764lb)-thrust BMW 003A turbojet engines (2 x RD-20s fitted on subsequent prototype and production examples)

Dimensions

Span	10m	(32ft 9¾in)
Length	9.75m	(31ft 11¾in)
Height	3.23m	(10ft 7in)
Wing area	18.2m²	(196ft²)

Weights

Empty	3,283kg	(7,238lb)
Loaded	4,860kg	(10,714lb)

Performance

Max speed	864km/h (537 m.p.h.)	at sea level
Climb	4min 30 sec to 5,000m (16,400ft)	
Service ceiling	13,000m	(42,650ft)
Range	800km	(497 miles)

Yakovlev Yak-15

Powerplant (prototype) 1 x 900kg (1,984lb)-thrust Junkers Jumo 004B turbojet engine (1 x Klimov RD-10 fitted on subsequent prototype and production examples)

Dimensions

Span	9.2m	(30ft 2¼in)
Length	8.7m	(28ft 6½in)
Wing area	14.85m²	(160ft²)

Weights

Empty	1,918kg	(4,228lb)
Loaded	2,634kg	(5,807lb)

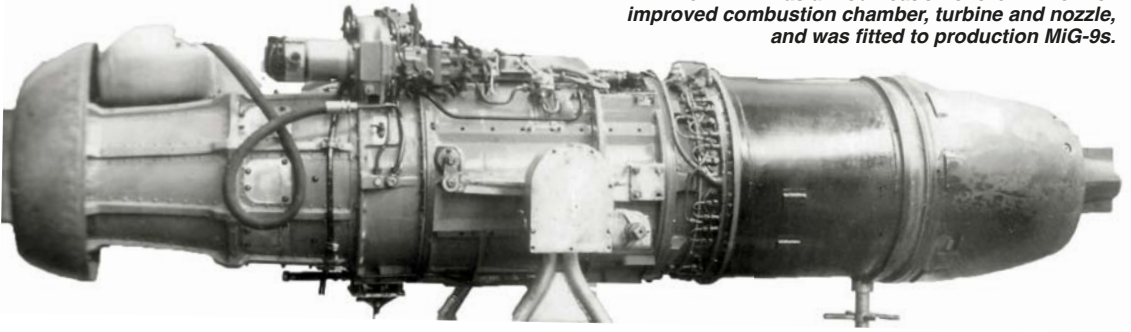
Performance

Max speed	786km/h (488 m.p.h.)	at sea level
Climb	4min 40 sec to 5,000m (16,400ft)	
Service ceiling	13,350m	(43,800ft)
Range	510km	(317 miles)

The Yak-17 was an improved Yak-15, fitted with a strengthened wing and a tricycle undercarriage, although the latter proved problematic. The nosewheel was largely external, being fitted to a faired levered-suspension oleo strut which formed the front half of a ventral bulge when retracted.



The RD-21 was a modification of the RD-20 with improved combustion chamber, turbine and nozzle, and was fitted to production MiG-9s.



“THE REACTIVATION OF MILITARY-PURPOSE FACTORIES IN GERMANY WAS IN BREACH OF THE AGREEMENT AMONG THE ALLIES, SO WORK WAS DONE IN STRICT SECRECY . . .”

in June 1946, and the new BMW 018, capable of 4,000kg (8,820lb) static thrust, that October.

Reactivating military-purpose design bureaux and factories in Germany was in breach of the agreement among the Allies, so work was done in strict secrecy, and any German breaching secrecy procedures faced extremely serious consequences.

WORK AT DESSAU

Dr Alfred Scheibe, formerly of Junkers, was appointed chief designer of the OKB-1 engine department at Dessau, tasked with the preparation of the Jumo 004F, the first prototype of which was ready by May 1946. However, instead of the 1,200kg of thrust expected of the engine, the most that could be coaxed out of it was 1,050kg of thrust and a service life of only 25hr. Development of the Jumo 004F was terminated in September 1946.

The Jumo 012 was the most powerful turbojet developed during World War Two and was

therefore deemed of vital importance to the post-war development of the jet engine by all parties. Some of the drawings of the engine were destroyed by the Germans when American forces approached Dessau. After its capture, the Americans found a turbine and a compressor at the factory and sent them to the USA for studying. Soviet experts started looking for Jumo 012 drawings and parts in September 1945, and by May 1946 all drawings had been restored with the help of German experts; by September 23 of the same year the first Jumo 012 engine prototype had been assembled. However, tests of the first three Jumo 012s revealed problems with the integrity of the blades.

PROGRESS AT STRASSFURT

Meanwhile, work continued at OKB-2 at Strassfurt, where the chief designer was K. Prestel, general supervision being vested in A.I. Isaev. The first BMW 003C had been manufactured by June 14,



With a somewhat waddling appearance from the rear, MiG's FT/FT-2/MiG-9UTI was developed as a two-seat trainer, the first prototype FT-1 making its first flight in July 1947.



1946, and another six engines had been delivered by October. The service life of the engine was gradually increased up to 35hr during the course of development.

The first BMW 018 was delivered on October 18, 1946, but it was not to be tested in Germany. Back in April 1946 the authorities had decided to transfer the German OKB design bureaux to the Soviet Union in order to maintain even tighter security. On the morning of October 22, all German employees and their families were hastily loaded on to military trucks before being sent to the Soviet Union aboard troop trains. All German jet engine specialists were housed in the Upravlencheskiy village outside Kuybyshev (now Samara) in south-eastern Russia. There they refined the BMW 003C and the Jumo 012 into turboprop engines "022" (based on the Jumo 012) and "028" by the end of 1947. The BMW 003C was refined by Soviet designers alone without any German experts.

A poor-quality but rare photograph of a line-up of Yak-17 single-seat fighters, the vast majority of Yak-17s built being two seat Yak-17UTI trainers. The type entered service with the Independent Air Training Regiment (UTAP) at the end of 1946.

PHILIP JARRETT COLLECTION



By early 1948 the Jumo 012 had been developed into the "012B" turbojet, the service life of which had been increased to about 100hr by the end of the year. Work on the "012B" was terminated when the more refined British Rolls-Royce Nene was launched into production, however.

It is worth noting that all Germany's turbojets had a 25–30 per cent greater fuel consumption, and about a 2.5-fold greater specific weight, than those of Rolls-Royce's Nene and Derwent engines. The Germans, however, achieved a smaller engine diameter, owing to their incorporation of axial-flow compressors.

SOVIET SELF-SUFFICIENCY

The "022" turboprop engine (later designated TV-022 and TV-2) was successfully tested in 1950 and was put into series production under the NK-2M designation. It also became the basis for the TV-2F and twin 2TV-2F powerplant, the latter comprising two turboprop engines driving a single reduction gear. The well-known NK-12 turboprop, which would power the mighty Tupolev Tu-95 *Bear* bomber, was to be the last engine developed jointly with German specialists, the last of which left Upravlencheskiy in late 1953.

The domination of German turbojets in Soviet post-war aviation lasted a relatively short time — not a single aircraft type powered by such engines may be said to have been produced in any great numbers. German engines were soon replaced by British powerplants on the assembly lines of Russian factories, the Soviet Union having procured samples of Rolls-Royce's Nene and Derwent turbojets, quickly measured and studied them, and put them into mass production as the RD-45 and RD-500 respectively. Thousands of MiG-15 fighters and Ilyushin Il-28 bombers powered by these engines would become the backbone of the Soviet Air Force in the early 1950s.



ANYTHING, ANYWHERE, ANYTIME PROFESSIONALLY

The Tet Offensive and its Aftermath



A characteristically anonymous Air America de Havilland DHC-4 Caribou taxis in at Lima Site 20, Sam Thong, on January 9, 1966. Among many Air America aircraft at Sam Thong that day was Prestwick Pioneer XL665, on loan from No 209 Sqn, based at Singapore, for use by the British Embassy. Why was the British Ambassador at a secret CIA airstrip in Laos in January 1966? The author reveals all in a forthcoming feature in TAH — watch this space!

JONATHAN POTE

THE STATUS QUO changed forever in 1968. On December 24, 1967, a USAF TACAN (Tactical Air Navigation) beacon sited just east of Savannakhet in central Laos, one of half a dozen illegally located in that country to aid the war in Vietnam, was destroyed by North Vietnamese troops. Although this hampered air operations in the nearby northern area of South Vietnam, nobody realised the significance of this attack immediately. President Lyndon B. Johnson ordered a Christmas bombing pause over North Vietnam, hoping for talks with the regime there. He extended that pause when in January the North Vietnamese

In the concluding half of his in-depth two-part series on the previously unpublished history of Air America — “the CIA’s secret airline” — in Laos, **JONATHAN POTE** details the gradual winding-down of the company’s efforts in the wake of North Vietnam’s surprise Tet Offensive of January 1968. With air combat over Laos ceasing, and other organisations shouldering the responsibility for food and munitions drops, Air America found itself increasingly removed from the centre of operations



government announced that talks were agreed.

The South Vietnamese government and the Viet Cong also agreed a ceasefire over Tet, the Vietnamese Lunar New Year. This time, the American government had indeed been naïve. On January 31, the eve of the Tet celebrations, North Vietnamese forces attacked 36 out of 44 provincial capitals in South Vietnam, and the world looked on as American might was humiliated. The change in Laos was that henceforth all fighting would be done by North Vietnamese units and the Pathet Lao irregulars would be sidelined.

Fighting would also continue throughout the wet season as well as in the drier months, and

the towns of Attopeu and Saravane in southern Laos would have to rely on air supply (largely by Air America) in the future. Both towns fell to the North Vietnamese in 1970. The increased tempo of North Vietnamese aggression greatly increased the number of refugees (to more than half a million), and, to feed them until they could produce crops once they were resettled, rice drops increased to 10,000,000lb (4,536,000kg) per month. Although there were some successes by Royal Lao Government forces, from now on the communists gained territory inexorably.

In March 1968 Phou Pha Thi (Lima Site 85) fell to an “at whatever cost” attack by North

Bell 204B N8513F was one of the first examples of the type acquired by Air America, in September 1965. It would go on to see a great deal of action in Vietnam and Laos throughout the conflict before being evacuated from Saigon aboard the USS Denver on April 29, 1975.

MIKE HOOKS COLLECTION

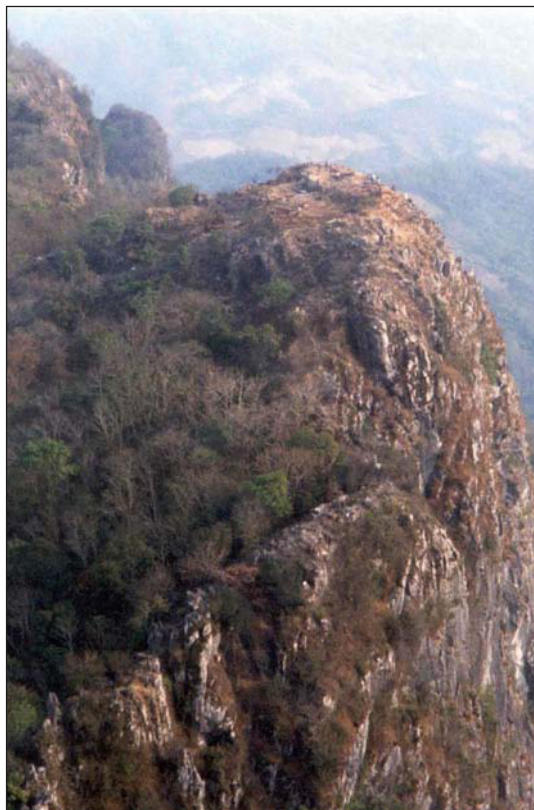


Vietnamese regular soldiers. This dramatically steep 5,000ft-high limestone karst, or outcrop, was in a strategic location near the North Vietnamese border and mounted a TSQ-81 radar and TACAN beacon to guide USAF aircraft in the Hanoi area. It was deep within enemy-held territory, entirely supplied by air and largely staffed by American civilians, many of whom died despite heroic rescue attempts by Air America helicopters. In an effort worthy of a Medal of Honor had they been in conventional military forces, Capt Kenwood held one skid of his Bell UH-1 Huey in contact with the clifftop, under effective communist fire, while Loy M. "Rusty" Irons assisted surviving technicians to climb aboard across the abyss below.

Helicopter vs biplane

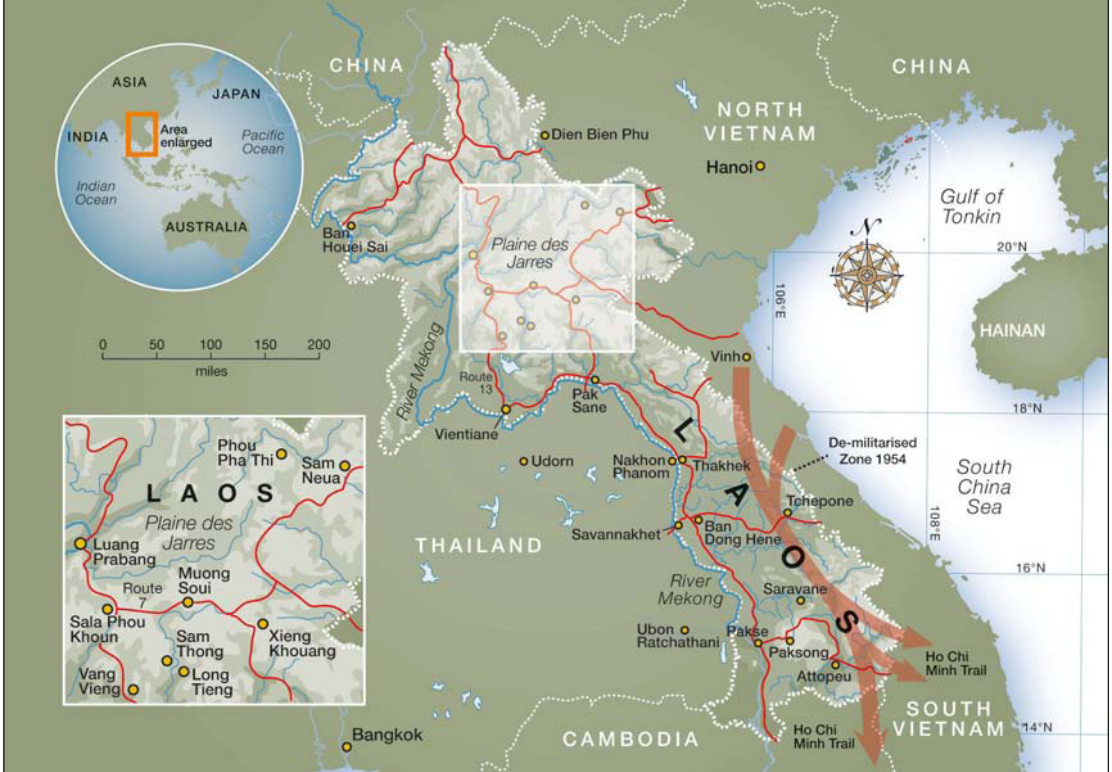
Air combat over Laos ended on January 11, 1968, as bizarrely as it had begun in 1961, with Communist Antonov An-2 *Colts* bombing the site being intercepted by a (civil-registered) Air America Huey, one or possibly both *Colts* being shot down by a hand-held machine-gun firing through the Huey's cabin door. The Air America crew members were immediately sacked, but then reinstated with commendations. (In 1961, Lt Khanpanth of the Royal Lao Air Force [RLAF] fatally damaged a Soviet-crewed Ilyushin Il-14 *Crate* over northern Laos, using his North American AT-6 Texan's air-to-ground rockets).

The pressure was on and (as in the wider conflict in South Vietnam) defeat loomed. Sikorsky UH-34s continued to shuttle troops, at times friendly soldiers in Pathet Lao uniforms. While inserting troops thus dressed was at times tense, picking up



JEANNIE SCHIFF/USAF

ABOVE The forbidding limestone outcrop of Phou Pha Thi, also known as Lima Site 85, where American forces operated a valuable radar station until it was overwhelmed by North Vietnamese troops in a hard-fought "at whatever cost" attack on March 10, 1968.



unknown, but believed friendly, troops in enemy uniforms at remote rendezvous points must have been very fraught indeed. In 1969 Vang Pao (pictured **INSET BELOW**) re-occupied the Plaine des Jarres for the first time in nearly a decade, capturing 25 Soviet-supplied PT-76 tanks, 200 lorries and thousands of tons of supplies — but it was a last gasp. The communist backlash in 1970 pushed his troops off the Plaine and pursued them south-west.

On March 13, 1970, a small elite North Vietnamese force captured Sam Thong, destroying the hospital and Air America facilities abandoned only hours before. The same year the “milk run”, Air America’s scheduled services to the major Mekong River towns using Douglas C-47s and de Havilland Canada DHC-4 Caribous, was terminated. The management of Air America felt obliged to tell its aircrew on other duties that they could refuse missions they deemed too dangerous. The memo listed the names of more than a dozen aircrew killed or missing in the previous year, and authorised crews to assess whether the risk of each mission was worth the potential benefits. Even “soft rice” (food) drops routinely drew anti-aircraft fire, although as the company had added “hot soup” (napalm canisters rolled out of freight doors over suspected communist troop concentrations) to its “menu”, this was not surprising. In fact Air America stopped dropping

rice altogether in 1971, as Continental Air Services Incorporated (CASI) offered a cheaper quote for the contract.

Times get tough

Air America had to fight commercial competition as well as the communists and six of the now redundant Curtiss C-46 Commandos were sent to Tainan on Taiwan for storage. On December 27, 1971, Fairchild C-123 Provider “293” (originally C-123B 57-6293, by 1971 a C-123K) was lost without trace with four on board.



As this loss was near the site of a road being built into northern Laos by the Chinese, it is likely that this new enemy was at fault. The purpose of this road was never entirely clear — from the southern border of communist China, it crossed some of the planet’s most treacherous terrain and by the end of the war had reached Thailand. It seemed to have no relevance to the North Vietnamese struggle, other than Communist China being one of North Vietnam’s major allies. It was an incredible engineering achievement, a proper all-weather road, unlike the Ho Chi Minh Trail, and was fiercely defended by Chinese anti-aircraft weapons, making it one of the most dangerous areas of Laos.

If the dangers of the task were not enough, Air America crews were occasionally murdered by their own side. On May 13, 1969, William J. Gibbs



JONATHAN POTE

ABOVE Sikorsky UH-34D "H-F" of Air America lands at Sam Thong in January 1966. Most UH-34s used by Air America in Laos were serialised with the letter H followed by a number and it is probable that by the time the author arrived in country in 1965 "H-F" was a unique survivor of a previous identity system used by Air America in Laos.

refused to take some Royal Lao Army troops aboard UH-34D "H-68" at Ban Dong Hene. As the helicopter lifted off, he was shot and fatally wounded. Fortunately for others on board, he was not the sole pilot. Not long afterwards, on August 19, 1969, Capt Ralph S. Davis was flying the short hop from "Alternate" (LS 20A, Long Tieng, the busy secret airbase on the other side of Skyline Ridge) to Sam Thong in Pilatus Turbo Porter N196X when he was fatally shot by "friendly" troops. All 13 aboard died.

There were still some innovations to come. North Vietnamese Ilyushin Il-28s bombed Ban Luang on the Plaine, and the Vietnam People's Air Force (VPAF) began using the captured airfield at Tchepone in south Laos after October 1968. On the night of December 6–7, 1972, a Hughes 500P (N351X or N352X) helicopter flew out of Thakhek to near Vinh (in North Vietnam) where a wire tap was successfully inserted for eavesdropping military telephone lines. A small device was attached to a telegraph pole and a relay station placed in a tree atop a high hill nearby. Once it was confirmed that the telephone conversations were being intercepted by American forces in Thailand or South Vietnam, the helicopter withdrew, still unnoticed. Night supply drops around the Ho Chi Minh Trail complex were made by de Havilland Canada Twin Otters using terrain-following radar. One once flew into North Vietnam, landing at Dien Bien Phu (the valley where the French were defeated in 1954) supporting a commando raid.

Of somewhat dubious value, a Caribou was used to drops millions of counterfeit currency notes over areas controlled by the Pathet Lao in an attempt to destroy an economy that probably did not rely on paper currency at all. However, the CIA had decided, on April 21, 1972, that air assets

such as Air America were no longer a viable way to do business and that with the impending end of the war in south-east Asia they would be liquidated. Even with the death sentence pronounced (but not communicated to those on the front line), the year's budget exceeded US\$40m and the company lost 12 aircraft and many crewmen that year.

Providers down

On December 6, 1972, the four crew of C-123K Provider "648" had a remarkably lucky (or unlucky, depending on how you look at it) escape. With their aircraft disabled by anti-aircraft fire near Paksong in southern Laos, all were able to bale out within the small confines of a friendly area. Three were picked up by UH-34D "H-52", which suffered a tail-rotor tree strike with the third lift. With "H-52" forced to land in a minefield, "H-53" was near enough for a quick lift. However, "H-53" had extended on task for this snatch and soon had to put down, out of fuel. Finally turbine-powered Sikorsky S-58T XW-PHE brought everyone to Pakse, where they were reunited with the fourth crew member — who had required just one helicopter rescue compared to their three.

On February 9, 1973, Provider "374" was shot down near Thakhek, with only one survivor. Less than two weeks later, on February 21, a ceasefire came into force and CASI (as the less "politically offensive" airline) took over most of Air America's contracts.

The company's forward air control Ravens (see Part 1 in *The Aviation Historian* Issue No 2) immediately disappeared from the scene. Little else changed, however. The USAF used its full bombing inventory in the north of Laos now that it no longer raided North Vietnam and the 919th

Air America and the nightmare of playing hard and fast with identities . . .

ONE OF AIR America's most interesting facets concerns the identity painted on each individual airframe. Each sovereign state has allocated prefixes to allow it to maintain an internationally recognisable register of its civil aircraft. Likewise, its military authorities can allocate serials which are complemented by recognised national markings which are also internationally acceptable. Air America did not see the need to comply with these protocols in Laos. Chiang Kai-shek's government in Taiwan used a simple "B" followed by a number for its civil aircraft, and Air America's aircraft in South Vietnam were on this register. In Laos, just as the Geneva Accords came into force in July 1962, the B prefix was removed both to further the aim of "plausible deniability" and because the Chinese Nationalist Government on Taiwan was politically unpopular in the area. Thus Air America used a simple three-figure number for each airframe (although from the mid-1960s some were placed on the Lao civil register, prefixed XW-). This number could be derived from a Taiwanese registration, the previous USAF serial number, the aircraft's constructor's number, or (it would seem) randomly drawn from a hat. The American FAA annotated the records of some Air America and other CIA aircraft as "File in locked drawer", presumably to avoid unauthorised investigation.

Thus Douglas C-47A B-817, the first Civil Air Transport aircraft into Laos, became "817" (but had reverted to B-817 when the author last saw it in Saigon in 1966). If the USAF serial was the basis, usually the "last three" appeared (for example C-47B 45-994 became "994"). Occasionally any three were used (e.g. C-130A 56-0510 became "605"). This aircraft was lost on approach to Lima Site 20A, Long Tieng, on April 10, 1970, when it hit Phou Bia, a 7,500ft-high mountain). In 1971 the Royal Australian Air Force (RAAF) gave C-47 A65-16 to the Royal Lao Air Force. Originally built as 42-24136, it became "998" from its constructor's number, 9998, probably because there was already an RLAFF aircraft marked "136". Although this was an RLAFF aircraft, it is very likely that Air America at Udorn in Thailand prepared it for service and chose its number. A considerable benefit of Air America running its own company register was that any aircraft lost would not be subject to any inquiry by authorities outside the company itself. Because there is no record of international recognition of these identities, quotation marks have been used to identify them in the main text.

Even these dubious identities were further corrupted at times. Sometimes, more than one aircraft carried the same identity, the Lao civil marks XW-PEA being known to have been carried by three separate Helio Couriers simultaneously. Aircraft used on the more covert missions changed identities to provide alibis for known Air America aircraft. Constructor's plates as well as exterior markings were removed from some airframes and engines when this level of evasiveness was reached; a nightmare for engineers maintaining powerplants of unknown variant or hours run. Constructor's plates were further abused; an aircraft could be destroyed and yet reappear, fully serviceable, on the flight line within days. In this case a replacement airframe would have been obtained from the American military, repainted as the lost aircraft, and the constructor's plate transferred. This ploy was used to "prove" that the original destroyed aircraft could not have been in Air America service. Most of Air America's aircraft bore no paint bar their number, which aided rapid changes of identity: "All you need is a tin of paint and three hours" was one quote referring to this frequent event.

In an ironic double bluff, USAF crews flying unmarked USAF C-130s out of Takhli in Thailand were issued with Air America flight suits and badges. Better to be seen as part of the airline that should not be there rather than the USAF, which definitely should not be carrying out a covert task!

Douglas C-47B "994" at Thakhek East in 1966. The aircraft was polished bare metal with its identity repeated on the nose and "Air America" painted on the rear fuselage — this aircraft, C-47 "147" and Caribou "392" were the only Air America aircraft to bear the company name in Laos.

JONATHAN POTE





ABOVE Curtiss C-46 XW-PBW, bare metal apart from Lao Erawan insignia on the fuselage and upper port wing surface and Lao flag on the tail, prepares to take off on a sortie from Vientiane in June 1966. Note the Sikorsky UH-34D of the International Control Commission, used to fly officials around Laos and Vietnam, parked opposite.

BELOW In April 1965 Continental Air Services Inc (CASI) was formed as a subsidiary of Continental Airlines with a view to “helping” Air America with its commitments in Laos; in reality Continental wanted a share of the government’s subsidies for such work. CASI operated Lockheed L-382s into Laos for a brief period during 1965–66.

Air Transport Regiment of the VPAF continued to fly into airstrips in the north-east of Laos, principally at Sam Neua. The remaining Providers (by now all modified to C-123K status with auxiliary General Electric J85 turbojets) were transferred to the Royal Lao Air Force, although “524” was lost en route to Ban Houei Sai while still with Air America. The wreckage was not found for more than a week, despite intense searching, and even then could not be approached because of enemy ground fire. That it was again near the Chinese road was a probable explanation for the loss, the crew of five having lost their lives transporting a cargo of empty pallets.

Since 1966 Volpar N9542Z (a modified Beech C-45) had been used on 12hr photo-reconnaissance missions high over the Ho Chi Minh Trail area, using World War Two-vintage Fairchild cameras. On July 31, 1973, so close to the end of the chapter, the aircraft sustained severe damage from anti-aircraft fire. The pilot in command, Capt Pat

Thorson, was fatally injured, although the copilot made a safe landing at Pakse. The author had seen N9542Z at Don Muang airbase (Bangkok) in 1966. Although the cameras were later updated, this ageing twin had provided almost all the photo-reconnaissance data required in Laos for a decade. It was replaced by Lockheed SR-71 Blackbirds and satellites — a quantum leap in technology.

The final days

By November 1973 only half-a-dozen Air America aircraft remained in Laos; C-123K Providers used to convert RLAF crews and C-46 Commandos XW-PBV and ‘PBW, which flew in Lao markings and did not publicise their ownership. On April 5, 1974, the communist Provisional Government of National Unity was formed. All American assets departed, although the embassy was closed for just one day before it was reopened by the new regime. On June 3, Caribou “389” crossed the Mekong River “at 1113Z” (around 1800hr local time)



Caribou "393" was one of several C-7As bailed from the US Army, with which it was serialled 61-2393. Here it thunders down the runway at Sam Thong in January 1966. Sam Thong was typical of the primitive strips from which Air America aircraft operated, offering little margin for error and a requirement for superb airmanship.

JONATHAN POTE



"On June 3, 1974, Caribou '389' was the last Air America aircraft out of Laos, and was flown by Captain Fred Walker, who had flown the first CAT C-47 into Vientiane in 1957 . . ."

bound for Udorn in Thailand. The last Air America aircraft out of Laos, it was flown by Capt Fred Walker, who had flown C-47 B-817 of (then) CAT into Vientiane in 1957, to start the whole saga. The last telex from Air America's Lao office to that of the Chief Executive ended with the following:

"And, in remembering, we will smile and look ahead to the next challenge. We grieve for those missing and dead in Laos and regret that they too could not have enjoyed today."

Air America operations from Udorn also rapidly wound down (from 14 aircraft in May 1974) and the last Air America flight out of the Thai airbase, on June 30, 1974, was Volpar N3278G on a ferry flight to Saigon, where the airline would continue to operate until that city fell on April 30, 1975. That last flight schedule document typed at Udorn bore a typed "Adieu" under the flight details, along with the following:

"So ends the last sentence of the final paragraph of a saga which may have an epilogue but never a sequel. It has been to each participating individual an experience which varied according to his role and perspective. However, there is a common bond of knowledge and satisfaction of having taken part in something worthwhile and with a slight sense of pity for those lesser souls who could not, or would not, share in it. This last flight schedule is dedicated to those for whom a previous similar schedule represented an appointment with destiny."

In Saigon flight operations continued to the end. Indeed, Air America aircraft extracted the vast majority of those who fled that doomed city, both

to Thailand and to aircraft carriers offshore. On April 29, 1975, the day before Saigon fell, C-47s "994" (originally 45-0994) and "147" (originally 43-16147) were among the last fixed-wing aircraft to leave. A decade before, in easier times, the author had flown in them several times around Laos.

Air America passes into history

Bailed aircraft were returned to the American government. Legally-owned aircraft, 24 in all, and a large spares holding, were collected and valued for liquidation in a sale at Roswell, New Mexico; a C-46 Commando, "equipped with antique tube electronics", was valued at \$20,000, a Caribou at \$100,000. Some US\$20m was eventually returned to the USA's treasury. Thus Air America passed into history. There has never been, nor ever will be again, anything like it. There was indeed no sequel, just as the last flight authorisation sheet prophesied. The USA still has clandestine work to be done, but it uses other methods.

This history is dedicated to the 243 men of Air America who were killed in service, mainly in action. Undoubtedly I met some of them, and like many other Americans I knew in south-east Asia, they were brave men who gave their all in a cause they truly believed in, however harshly history has subsequently judged them.



OVERLEAF — the author's eyewitness listing of aircraft seen operating in Laos during September 1965 to August 1966. Although by no means a comprehensive list, it is, we believe, one of the most thorough yet published

Aircraft in Laos, September 1965–August 1966

Contemporary eyewitness record compiled by JONATHAN POTE, Volunteer in the Colombo Plan Medical Team, September 1965–August 1966, revised and added to from other sources

(Notes in italics are added from Professor Joe Leeker's research)

Beech C-45 and derivatives

XW-TAP C-45 Silver overall, VTE
24 Sep 65
XW-TBC C-45 Silver overall, parked
VTE, rarely flown
XW-TBD ditto 'BC
XW-TBF ditto 'BC
F-OAGB C-45 Silver overall, white
decking, blue cheat line. Tricolour on
rudders. *AMBASSADE DE FRANCE*
above windows. Black inner nacelles.
Ld TK West 6 Mar 66
N801T Possibly mis-ident for N906T
N906T Super H-18, c/n BA667. Yellow
and cream, Air Vietnam insignia on tail,
blue boar head insignia of 390th Tactical
Fighter Squadron (Vietnam) on fuse-
lage. Seen VTE 23 Jan 66 (for o/haul)
N5454V C-45 Light grey overall, silver
control surfaces. Black registration rear
fuselage only. VTE 30 Jan 66
N7591C Used by Air America.
Ambassador's aircraft, USA flag behind
cockpit. Deep blue and silver. Minor
prang TK West 19 Jan 66
N9664C As '91C but "64C" repeated
on nose. First seen VTE 18 Apr 66

Curtiss C-46 Commando

Air America

136 TSN, 6 May 66. Air America,
aluminium overall
136 Curtiss C-46F, c/n 22465,
44-78642. "To CAT 1953, destroyed
Pha Khao 13 Aug 61, 6 killed" — but
seen as above
138 VTE and TSN, 6 May 66. Air
America, aluminium overall
138 Curtiss C-46F, c/n 22500,
s/n 44-78677. Possibly at Takhli 61, at
VTE 64, TSN 66, Taiwan 71.
910 VTE 24 Sep 65 and 27 Sep
65. Air America, aluminium overall
924 VTE 2 Oct 65. Air America,
aluminium overall
N1361N VTE. Air America, aluminium
overall
N1383N VTE and flew SKT—VTE 11
Aug 66. Air America, aluminium overall
N1383N Curtiss C-46D, c/n 33641,
44-78245. To Air America Oct 1963,
damaged at VTE 24 Jan 65 when T-28
exploded. Kicker T. Homhuan fell out 26
Mar 70 and survived, rescued by UH-34
"H-62". N1383N became RP-C1461 in
Philippines 1975, wfu 1980
N1386N VTE and flew VTE—SKT 16
Oct 65. Air America, aluminium overall.
Crashed EFATO SKT 25 Nov 68; 23
pax, three crew killed, two pax survived
N1386N Curtiss C-46D, c/n 22265,
44-78442. To USAID VTE 1964.
Parachutist killed 3 Sep 64, 'chute did

not open. 25 Nov 68 crashed after
take-off at Savannakhet, two miles from
runway at 1530hr local. Engine failed,
wing burned, aircraft broke up. "24
killed"

N9458Z VTE 8 Jan 66, Air America,
aluminium overall, AF O-477589 erased
but visible (possibly ex-44-77589)
N9458Z Curtiss C-46D, c/n 32985,
44-78589 (NB different from above). To
Air America Nov 65, to South Vietnam
1971?, left TSN on 29 April 75 as
Saigon fell, flew to Taiwan. Became
RP-C1462 in Philippines

Bird & Sons/Bird Air

N65561
N67961 VTE 27 Sep 65. Blue cheatline
N4871V VTE Brown cheatline
Cannibalised, less outer wing panels
and engines
N7560Z VTE
N9473Z VTE 2 Oct 65, 4 Jun 66
N9473Z Curtiss C-46F, c/n 22293,
leased by Air America ex Bird & Sons,
crashed after engine failure, Phu Cum
(LS 50), with CASI, 13 Aug 67. Port
engine hit by enemy fire, forced-landed
off airfield, one crew seriously injured,
four pax, other crewman OK
N9760Z VTE 27 Sep 65, 2 Oct 65.
Blue cheatline
N9760Z Curtiss C-46F, c/n 22574,
leased by Bird & Sons to Air America
1964. To "Tri-9 Corp" in Phnom Penh,
destroyed by rocket 26 May 72

Lao Register

XW-PBV VTE 27 Sep 65. Bare metal,
Erawan insignia
XW-PBV Curtiss C-46D, c/n 22232,
s/n 44-78409. Used for arms drops in
Cuba 17–20 April 1961, before Bay of
Pigs invasion. Became B-914 after, to
Laos 63 as XW-EAA. Air America to
USAID, then to Royal Lao govt as 'PBV
in 1964. Damaged in storm at VTE 24
Mar 76, then registered RDPL-34040
XW-PBW VTE 4 Jun 66. Bare metal,
Erawan insignia
XW-PBW Curtiss C-46D, c/n 33451,
s/n 44-78055. At Bay of Pigs, Cuba,
1961, with false Guatemalan Air Force
serial "1887". To USAID and then Bird &
Sons, VTE, as XW-EAB. Became
XW-PBW in 64, to Royal Lao Govt 1
Dec 73, crashed 75 miles NNE of VTE
15 Oct 74
XW-PCU VTE 13 Feb 66, Royal Air Lao,
ex-Air Vietnam; white decking, deep
blue upper cheatline, red lower
cheatlines, overall gloss grey. Nacelles
black under wing. Believed ex-B-517

Lisunov Li-2 Cab (Russian licence-built Douglas DC-3)

01 Silver grey overall, derelict at

VTE since Phoumi's Coup in 1960
611 Olive drab overall, ex-Aeroflot,
derelict VTE since Phoumi's Coup 60
627 As 611
651 As 611

Douglas DC-3/C-47 Skytrain

Royal Lao Air Force

Fin markings as noted by author
21057 SKT 8 Sep 65
127 SKT 8 Sep 65
51127 TKE 16 Jul 66. Marked as
51127 (not as 127), s/n 45-1127A by
plate. Neutral grey overall
48157 SKT 8 Sep 65
O-48159 TKW 18 Nov 65 and 20 Feb
66. VC-47D s/n 43-48159 by plate, but
bare interior with parachute rails though
still soundproofed. White decking, grey
belly, cheatline above and below
windows
24178 VTE 29 Jan 66 with Thai
football team, TKE 8 June 66 with
British Ambassador and other VIPs.
20-seat airline VIP interior. C-47A s/n
42-24178 by plate. Silver/grey overall
O-15316 VTE 29 Jan 66. VC-47D s/n
43-15316 by plate. Grey belly
356 VTE 2 Oct 65
49356 PSE 2 May 65. Landed. Grey
overall
374 SKT 8 Sep 65. Also TKE.
C-47D s/n 43-19374 by plate
375 SKT 8 Sep 65. In hangar, all
centre fuselage skin removed
O-316375 SKT 2 May 66. Blue serial and
cheatline. Rudder and elevators
removed
O-23398 SKT and PSE 8 Sep 65. TKW
15 Nov 65, TKE Jun 66, Dayglo arrow
on nose, black cowlings and fairings,
grey belly
869429 PSE 8 Sep 65
501 SKT 8 Sep 65, TKW Nov 65,
20 Mar 66
O-15519 SKT 8 Sep 65, PSE 2 May 66,
brought spares to repair "633" at TKE
Jul 66. White decking. Also TKW
November battle
633 VTE 24 Sep 65, TKW Nov 65,
crashed and repaired TKE 1 Jul 66
onwards, s/n 43-45633
656 SKT 8 Sep 65 and TKW
November battle
374656 SKT 8 Sep 65
47658 PSE 8 Sep 65
15666 TKW 12 Nov 65, LP 1966
C-47A s/n 43-15666 by plate
30678 TKW 1 Mar 66. Probably
C-47A 30678 by plate. Silver/grey
overall, upper inner nacelles and lower
fairings black
685 TKW 19 Nov 65 bringing
Prince Souvanna Phouma, Prime
Minister; C-47D s/n 43-48685 by plate.
Royal/Prime Ministerial aircraft of the

RLAF. Airline interior. White decking, markings outlined in yellow
 806 TKE 23 Mar 66
 956 unconfirmed
 47965 PSE 8 Sep 65, blue cowlings. Was later marked O-47965 at TKW in Nov 65. C-47A s/n 43-47965A by plate, sole RLAF C-47 with nose art, actually on upper fuselage side behind cockpit, on port (and possibly starboard) side — a stylised cooking-pot and fire with *Kim Gia* above and *Burner Special* below (Col Burner was US Military Attaché — USMA — in VTE). Based VTE, seen there 24 Sep 65. NB Air America had C-47 “965” (silver overall) at VTE on 8 Oct 65. Possibly same aircraft between two colour schemes
 108976 TKE. Newly repainted, no national markings, RLAF lettering painted over, black cheatlines above and below windows. Col Burner, USMA, aboard
 976 c/n 13608, ex-42-108976
Stored at Udorn 1973 still in RLAF markings
 991 SKT 8 Sep 65. TKW Nov 65. C-47A s/n 43-45991 by plate
 Nil TKW 18 Nov 65. Completely unmarked, “corroded aluminium” overall with sanded-off old-style USAF markings and serial O-00979 plus a badge still discernible. Believed to be C-47A-75-DL s/n 42-100979
 998 42-24136, ex-RAAF A65-16, VH-AFF, donated by Australia to RLAF 28 Aug 71. RLAF serial from c/n 9998

Air America

147 Aluminium overall. No marks, initially bar serial on fin. Milk-run regular
 147 Douglas C-47B c/n 20613, s/n 43-16147A. Bailed from USAF to Air America 61. Damaged at VTE on 24 Jan 65 when T-28 exploded. More damaged than “817”. To South Vietnam late 66. Struck steel bundle while landing at Ban Loc, Jan 69; lost starboard wheel, prop and tailwheel. Back in service Feb 69. Port mainwheel collapsed Ban Me Thuot East 71. Repaired. Due for return to USAF June 75, fled Saigon 29 Apr 75, the day before South Vietnam fell. To RTAF initially as 147, then L2-53/19. SOC 81
 817 As “147” but with B-817 discernable on fin. Milk-run regular until early 66. Seen in Saigon 6 May 66 freshly overhauled and marked as B-817 again
 817 Douglas C-47A c/n 19256, s/n 42-100793. To CAT 52 as B-817, sank in mud in Laos 60, hit truck VTE 61, taxi collision 63, premature undercarriage retraction 64, damaged by exploding T-28 at VTE 65, battle damage 66 while on training flight, mortared at Da Nang 67, rocket damage at TSN 68, to Khmer Air Lines 73 as XU-AAE
 879 Grey overall, fitted with cargo/ rice rollers on floor. VTE 23 Jan 66 and a few other rare occasions
 879 Douglas C-47B c/n 34325/

17058, s/n 45-1055. Previously B-879, used to drop to “Road Watch Teams” out of Udorn, late 60s. To China Airlines 74 as B-1555. WFU 77
 965 Aluminium overall, seen VTE 8 Oct 65. Possibly 47965/O-47965 of RLAF
 994 C-47B. As “147”
 994 C-47A, c/n 34259, 45-994. (USAAF serials states C-47B). Bailed to Air America 60. To South Vietnam late 66. Due for return to USAF June 75, escaped from TSN on 29 Apr 75 to BKK as Saigon fell. To RTAF as L2-54/19

In mid-June 1966 “147” and “994”, the remaining milk-run regulars, were given a polish, their serials repeated on the nose, and a stylised “Air America” painted on the fuselage sides

United States Air Force

348311 VTE 15 Oct 65. First seen at Don Muang, BKK, 1 Sep 65 as a US Navy R4D, then in VTE as the Bangkok US Air Attaché aircraft. White decking
 45-1093 VTE, 8 Oct 65 and 15 Oct 65. Full USAF colours
 O-16364 VTE, 1966. Possibly USMA aircraft

L'Armée de l'Air

49821 VTE 8 Oct 65. Callsign F-SDLR, French Air Attaché. White decking. Named *Chateau de Wattay*. Tricolore on fin. TKE to collect French professors for home leave mid-66. Beneath paint Iraqi Air Force markings and code letter “H” discernible

Royal Australian Air Force

A65-70 VTE 66. 2 Sqn RAAF. Silver with white decking, roundels above and below wings, fin flash and lightning insignia also on fin. See also RLAF “998”

Royal Air Lao

XW-TAD VTE. Red and white colour scheme
 XW-TAE scheme as XW-TAD
 XW-TAF BKK, VTE, PSE, LP. Scheme as XW-TAD
 XW-TAH scheme as XW-TAD

Others

XW-PAP C-47, ex-N7780C, USAF marks discernible, very scruffy, white decking, no underwing reg. Cargo rollers in cabin. PSE 8 Sep 65, TKW 20 Mar 66
 XW-PAR VTE 24 Sep 65. Red, white and blue flash. Operating with French airline Cie Veba Akat
 XW-PCP C-53 Skytrooper or DC-3 (small door). Arrived VTE about 26 Dec 65 as B-1533, with light grey control surfaces and wing underside, and Air Vietnam insignia on tail. N155A was discernible on rear fuselage under paint. Repainted as XW-PCP and in service by 29 Dec 65
 XW-PDA VTE 21 May 66. Operating with Cie Veba Akat

N560 VTE 24 Sep 65. Green cheatline
 N560K VTE 8 Jan 66. Continental Air Services Inc (CASI)
 N64910 VTE 24 Sep 65. CASI. Ex-Frontier Airlines. Possibly N64810
 N8744R TKW Nov 65. CASI. Silver, white decking, green cheatline

Douglas DC-4/C-54 Skymaster

XW-TAG Royal Air Lao, silver with emerald-green nacelles. VTE 2 Oct 65.

Fairchild C-123B Provider

All Air America aircraft; C-123Bs in 65–66, with underwing droptank lugs, aluminium overall, identity on fin only, red propeller warning bands. All surviving C-123Bs converted at Fairchild to C-123Ks with additional jet pods during 68–69
 “293” VTE 3 Jun 66
 “374” VTE 24 Sep 65, TKW Nov 65, ex-84374
 “538” TKW 17 Nov 65
 “613” VTE 18 Apr 66
 “617” VTE 1966
 “655” VTE 24 Sep 65, TKW Nov 65
 “671” VTE 66
 N5003X VTE 8 Sep 65
 N5003X c/n 20234, s/n 55-4573. Ex-347th Troop Carrier Squadron (TCS), Pope AFB, as “510”, then N5003X in 62. Ground collision 64, blew over several a/c 29 Oct 64 during run-up, crashed on go-around at LS 20A, Long Tieng, 3 Oct 65. Copilot Frank Muscal killed
 N5005X TKW Nov 65
 N5005X c/n 20236, s/n 55-4545. Ex-347th TCS, Pope AFB, 1962, as “530”, became N5005X. Landed short Jun 64, engine fire near Takhlil. Was Victor control 13 Oct 65 for crash of “H-32” near Saravane. Became “545” Jun 66. Starboard mainwheel collapse Nam Bac (LS 203) 18 Oct 65. To C-123K at Fairchild 68. Nosewheel collapse at Ban La Tee (LS 190). Caught fire Udorn 71. Severe battle damage 28 Dec 71. Double engine fire out of Ban Houei Sai 24 May 73, one prop blade through fuselage and hit opposite jet. Repaired, to RLAF 1973
 N5007X VTE 2 Oct 65. LP—VTE Jun 66
 N5007X c/n 20216, s/n 55-4555. Ex-347th TCS, Pope AFB, 1962, as “550”, became N5007X. Crewman Rizal Alomares fell out on to runway Udorn 65, killed. Became “555” in Jun 66. First Air America C-123B converted to C-123K, Apr 68. Hit by anti-aircraft fire despite civil registration 71. On 27 Aug 72 en route Vang Vieng (LS 20A) hit top of ridge in bad weather, nine killed

Lockheed L-382B (civil C-130)

Hercules

N9260R TKW 30 Nov 65. CASI)
 N9261R TKW, later than “60R. CASI. These two civil Hercules (the first to be built) were ordered by Alaskan Airlines but taken over by CASI. Arrived VTE Nov 65, contract cancelled mid-66

de Havilland Canada DHC-4/ CV-2A/C-7A Caribou

All Air America aircraft; bare metal overall, except "853" with identity on fin
 "389" VTE 27 Sep 65
 "392" VTE 24 Sep 65. s/n 61-2392.
 Sam Thong—VTE 9 Jan 66 and
 TK—PSN—VTE milk run 18 Apr 66
 "393" VTE 8 Sep 65
 "401" 24 & 27 Sep 65 & 7 Oct 65
 "430" VTE 8 & 24 Sep 65 & 2 Oct 65
 "851" VTE 8 Oct 65
 "853" DM 1 Sep 65, SKT 8 Sep 65,
 Sam Thong 9 Jan 66. Commissary
 aircraft, light grey overall

Sikorsky UH-34D Choctaw

Air America

All olive drab overall with white identity on fin. No other markings
 "H-F" Sam Thong 9 Jan 66. Believed to be sole survivor of earlier series of UH-34D identities
 "H-12" TKW 23 Jul 66, carrying Pathet Lao defectors. LP May/June 66
 "H-14"
 "H-15" TKW 1 Mar 66, refugee evacuation
 "H-22" TKW—Ban Na Koke—Ban Na Ken (north-east of Thakhek) 27 Apr 66, visited Japanese colonel. Helo missing for three days with CIA case officer aboard. Reason for absence not known
 "H-27" VTE 8 Sep 65, Sam Thong 9 Jan 66
 "H-28" Sam Thong 9 Jan 66
 "H-29"
 "H-30" PSE 8 Sep 65. Code "N9" discernible under paint
 "H-31" TKW 6 Mar 66
 "H-33" TKW, Nov 65. Ex-Bu Aer 149368 of US Marine Corps unit HMM-363, unit code YZ64 discernible beneath paint
 "H-34" VTE 2 Oct 65
 "H-35" Sam Thong 9 Jan 66
 "H-36" TKW 15 Mar 66
 "H-37" VTE 8 Sep 65. Sam Thong 9 Jan 66
 "H-38" 27 Apr 66. First of five "new" helos, "H38"—"H42", with dorsal antennae
 "H-40"
 "H-41" TKW 20 Jul 66, CIA case officer aboard

Royal Lao Air Force

Olive drab, Erawan on fuselage, white serial on fin
 "1332" SKT 8 Sep 65, TKW with Crown Prince 14 Sep 65, TKW Nov 65, landed twice in hospital grounds, presumed casevacs
 "1335" Based VTE, there 8 Oct 65, TKW 14 Sep 65 with Crown Prince
 "3846" TKW 9 Mar 66, "E3" and US markings discernible beneath paint

International Control Commission

White overall, based VTE for CIC
 (Commission Internationale pour/de Contrôle)
 Large "CIC" on fuselage, serial on fin.

"CIC 4" VTE 24 Sep 65
 "CIC 5" VTE 24 Sep 65
 "CIC 6"

North American T-28

All T-28s light grey overall, serial on fin. Many serials started O-13xxx, but this could not be written down for each aircraft as time was too short (aircraft side by side, seen from moving C-47). Many had an eagle insignia. Probably all had Erawan. Serials listed here in order of last three digits, unless full serial known. Believed disposition of RLAFF T-28s at the time: SKT 15; VTE 9; PSE 6; LP 3; others including Long Tieng 9; total about 42–45 ???
 Wreckage on strip CF4, Phou Khou Khouai, about 62 miles (100km) north-east of VTE
 "1225"
 "331" SKT 8 Sep 65
 "345" SKT 8 Sep 65
 "351" SKT 8 Sep 65
 O-00374 (?) Took off VTE 13 Feb 66, one of formation of nine
 O-13465 SKT 8 Sep 65, 16 Oct 65, low over Thakhek 11 Nov 65
 "467" SKT 8 Sep 65, 16 Oct 65
 "469" SKT 8 Sep 65
 "472" SKT 8 Sep 65
 "506" SKT 8 Sep 65
 O-13507 SKT 16 Oct 65
 "508" SKT 8 Sep 65, 16 Oct 65.
 Bombed target nine miles (15km) east of Thakhek 12 Nov 65

O-13518
 "531" SKT 8 Sep 65, 16 Oct 65
 "538" SKT 8 Sep 65, 16 Oct 65
 "608" SKT 8 Sep 65
 O-13617
 "7622" SKT 16 Oct 65
 "647" SKT 8 Sep 65
 O-13656 SKT 8 Sep 65
 "668" SKT 8 Sep 65
 O-13743 Took off VTE 13 Feb 66.
 Formation of nine aircraft
 "0765"
 O-13768 Wreckage (tail only) seen at VTE 13 Feb 66, believed to have crashed during low-level roll
 "3771" Took off VTE 13 Feb 66.
 Formation of nine aircraft
 "774" SKT 16 Oct 65
 "7777" SKT 16 Oct 65
 O-17779 SKT 16 Oct 65
 O-13791 Took off VTE 13 Feb 66, one of formation of nine aircraft. Possibly O-13719
 (Also O-17778 was seen at at Pochen-tong, Phnom Penh, serving with the Royal Khmer Air Force)

de Havilland Canada DHC-2/L-20A Beaver

Royal Lao Air Force

82046 SKT 16 Oct 65. Olive drab
 "2052" SKT 8 Sep 65. Grey overall.
 Serial 82052 in cockpit. Based VTE, at TKW 22 Feb 66. Seen SKT 2 May 66, minus rudder and elevator
 82052 c/n 1384, ex-58-2052
 82053 Olive drab, yellow serial on fin, RLAFF on fuselage, western script on port, Lao on starboard. Often at TKW,

based there during Battle of Thakhek, Nov 65. Carried 0.5in machine-gun in port cabin door, plus four small bomb racks under wings

82053 c/n 1385 ex-58-2053 RLAFF.

Returned to US Army, later became N577V, still current in Alaska in 2010

XW-TBB Silver overall, Royal Air Lao markings. Based VTE, seen there 24 Sep 65, 2 Oct 66
 F-OAIV French Embassy aircraft, based VTE. Silver, white top, tricolor on tail. VTE 24 Sep 65, Sam Thong 9 Jan 1966, TKW 24 Feb 66

Helio 395 Courier

All Air America aircraft. Bare metal overall bar serial on fin and black triangle under port wing, apex to rear
 "166" VTE 8 Sep 65
 "169" Ex-13169
 "183"
 "524" VTE 30 Jan 66
 "541" See XW-PEA
 "839" VTE 13 Feb 66, buckled rear fuselage; crated and sent to USA
 "845" VTE 24 Sep 65
 "857" VTE 11 Aug 66, brand new
 "865" VTE 24 Sep 65
 "869"
 "965" VTE 8 Oct 65
 XW-PBS
 XW-PBT VTE 2 Oct 65
 XW-PBX
 XW-PBY VTE 18 Apr 66, and remains at VTE 11 Aug 66
 XW-PCA Sam Thong 9 Jan 66
 XW-PEA TKW 23 Jul 66, "541" discernible under paint

Cessna L-19/O-1 Bird Dog

Royal Lao Air Force

"666" SKT 16 Oct 65, yellow overall, also TKE 1 Jul 66 after crash of C-47
 "633"
 "4364" SKT 8 Sep 65. Olive drab overall
 "6468" TKE 1 Jul 66 after crash of C-47 "633"
 ??? TKE. Abandoned fuselage, yellow overall, beside TKE all year.
 Ex-51-12650, c/n 23374

Pilatus PC-6A Turbo Porter

Air America

No standard colour scheme, all in individual markings
 XW-PBL VTE 8 Sep 65, crated for USA after crash near LP; 2 killed
 XW-PCB VTE 24 Sep 65, Sam Thong 9 Jan 66
 XW-PCC Mid grey overall, black cheatline
 XW-PCD
 XW-PCE Sam Thong 9 Jan 66
 XW-PCK VTE 26 Dec 65. Grey overall
 XW-PCL Sam Thong 9 Jan 66. White, blue cheatline and rudder mass balance
 XW-PCN VTE 26 Dec 65. Mid-grey overall
 XW-PCO Sam Thong 9 Jan 66.
 Mid-grey overall, black cheatline
 XW-PCQ Mid-grey overall

XW-PCR VTE 21 May 66. Mustard yellow overall
XW-PDC VTE 4 Jun 66. Yellow and white
N12235 LP 3 Jun 66. Blue and silver
N9444 VTE 11 Aug 66. Wrecked

Dornier Do 28

XW-PCG PSE 8 Sep 65, TKW15 Nov 65. Dull silver overall, maroon stripe, Vietnamese dragon on fuselage.
Do 28A-1 c/n 3026, built Friedrichshafen, initially N4222G. Used by Air America
XW-PCT See N9184X
XW-PDB See N4228G
XW-TBJ VTE 8 Oct 65, SKT 14 Dec 65, again in VTE late Dec 65 following crash. Used by Air America
N4224G VTE 8 Sep 65. Used by Air America
N4228G Do 28A-1. VTE Jan 66 on overhaul, then seen damaged. Silver overall. Seen re-registered as XW-PDB at TKW 22 Jul 66 and later
N9180X Do 28B-1. VTE 8 Jan 65; c/n 3085, built 64. VTE—Sam Thong 9 Jan 66
N9181X Do 28B-1 c/n 3086
N9182X Do 28B-1 VTE 8 Oct 65, TKW Nov 65; c/n 3087
N9183X Do 28B-1 VTE 23 Jan 66; c/n 3057
N9184X Do 28B-1 VTE 23 Jan 66, c/n 3058. Seen again PSE 2 May 66, silver overall, registered as XW-PCT
N9185X Do 28B-1 VTE 23 Jan 66; c/n 3059
N9186X Do 28B-1 VTE 23 Jan 66; c/n not noted

NB N9180X—N9186X were all red and cream. N9183X—N9186X were all built in 1965 and arrived at VTE on 23 Jan 66 after a ferry flight in loose formation. 5411lt overload tanks fitted for delivery

Cessna U-17A (Cessna 185 Skywagon)

64-14867 TKE 17 Jun 66. Light grey overall, Erawan on fuselage, full serial in black on fin, "867" underwing
64-17797 VTE 2 Oct 65. Written off VTE 12 Oct 65, burnt out after take-off crash. Pilot unhurt. Wreckage remained in VTE. Colours as 64-14867
65-10853 VTE 1 Jan 66 and later. Colours as above, but serial painted in light blue instead of black

Aero Commander 560

2714 Often seen VTE but based SKT. At TKW during Nov 65 fighting for Thakhek. Blue and white colour scheme, with fuselage Erawan; c/n 214, built Oklahoma March 1955

Beech L-23D Seminole

76061 VTE and TKW. US Army Attaché's aircraft. Red and white colour scheme

Republic F-105F Thunderchief

38365 12 Oct 65. Stores pylon only, in army camp at K15 Mahaxay

Mil Mi-4 Hound

14108 VTE all year. Derelict but complete, on north side of Wattay, with four Li-2s. Presentation aircraft from Soviet Russia 60

Prestwick Pioneer CC Mk 1

XL665 Arrived VTE 2 Oct 65. British Embassy aircraft, detached from 209 Sqn, Singapore; c/n 126. Camouflaged. Often used to bring British embassy staff to TKW, including Ambassador, Sir Frederick Warner, during the November fighting for Thakhek.

Scottish Aviation Twin Pioneer

XW-PBJ VTE 8 Jan 65, scruffy blue colour scheme. Used by CASI and fitted for cargo dropping. Built 1958, "PAL" (Philippine Air Lines) discernible beneath paint
XW-PBP VTE 16 Oct 65, and Sam Thong 9 Jan 66. White top, grey belly, wide black or deep blue horizontal stripe including windows and in front of cockpit. Neat. Also ex-PAL

Wren 460 (Cessna 182G)

N3790U VTE 24 Sep 65; c/n 182-55190

Piper PA-24 Comanche

N3267P VTE 24 Sep 65

Piper PA-23 Apache

N2267P VTE 11 Dec 65, CASI

Beechcraft Baron 55

N1349Z VTE 2 Oct 65, TKW 15 Nov 65 during fighting

Boeing 307 Stratoliner

F-BELV VTE 15 Oct 65. International Control Commission; c/n 1996, ex-TWA NC19905, later C-75 42-88624
F-BELX VTE 23 Jan 66 International Control Commission; c/n 1999, ex-TWA NC19907, later C-75 42-88625

NB For full information on the South-east Asian careers of these former TWA airliners, see the author's *From Penthouse to Workhorse* feature in *The Aviation Historian Issue No 1*

Lockheed L-188A Electra

VR-HFN VTE 23 Jan 66. Cathay Pacific Airways, second production Electra

Jodel D140B

XW-PCV VTE 4 Jun 66. Red and cream colour scheme

Notes on serial numbers etc

AF USAF serials
"O" e.g. "O-12345" is for "Obsolescent", and not a zero
B-XXX (e.g. B-607) Chinese Nationalist/Formosa/Taiwan register
"by plate" The stenciled full aircraft serial number (including fiscal year of order) behind cockpit on port side
c/n Constructor's number. Many C-47s were allocated the wrong number

by some admin error, and thus have a number on the maker's plate different from that allocated

"xyz" e.g. "991". Any (usually three-figure) number not thought to be a legitimate full serial, possibly the last three of a legitimate identity, or last three of a c/n, or just plain fiction (Air America types mainly), referred to as "identity" to indicate possible lack of legality. Serials, registrations and c/ns are considered legal identities

Discernible: possible to make out previous markings etc either under new paint or on a stripped area
"Silver/aluminium/light grey": Could be any of these, not specific

Abbreviations

BKK	Bangkok
CASI	Continental Air Services Incorporated
DM	Don Muang, Bangkok
EFATO	Engine failure after take-off
Erawan	Royal Lao Air Force national insignia (3 x elephants & parasol)
LP	Luang Prabang
LS	Landing site (LS 20A etc)
PSE	Pakse
RLAF	Royal Lao Air Force
RTAF	Royal Thai Air Force
SKT	Savannakhet
TK	Thakhek, East or West
TKE	Thakhek East. Usually known as K6 (Kilometer 6) locally. Wet weather alternate to TKW/K2 (see below)
TKW	Thakhek West. Usually known as TK2 (Kilometer 2) locally, flooded in monsoon
TSN	Tan Son Nhut, Saigon, (Ho Chi Minh City)
VTE	Vientiane (Wattay/Vattai etc)



ACKNOWLEDGMENTS

The author would like to thank Dr Joe F. Leeker for his help with the preparation of this two-part history of Air America in Laos. Professor Leeker is the custodian of the Air America Collection at the University of Texas in Dallas. For more information on the murky but fascinating world of Air America visit www.utdallas.edu/library/collections/speccoll/Leeker/history/index.html

el relámpago en argentina

*One of the many wartime-produced combat aircraft rolled out of America's factories with nowhere to go, Lockheed P-38L Lightning 44-27205 went on to enjoy a lengthy career as a post-war photo-survey aircraft, ultimately becoming the only Lightning to see civil operation in Argentina. **RICARDO M. LEZON** traces the career of this unique twin-boomer*

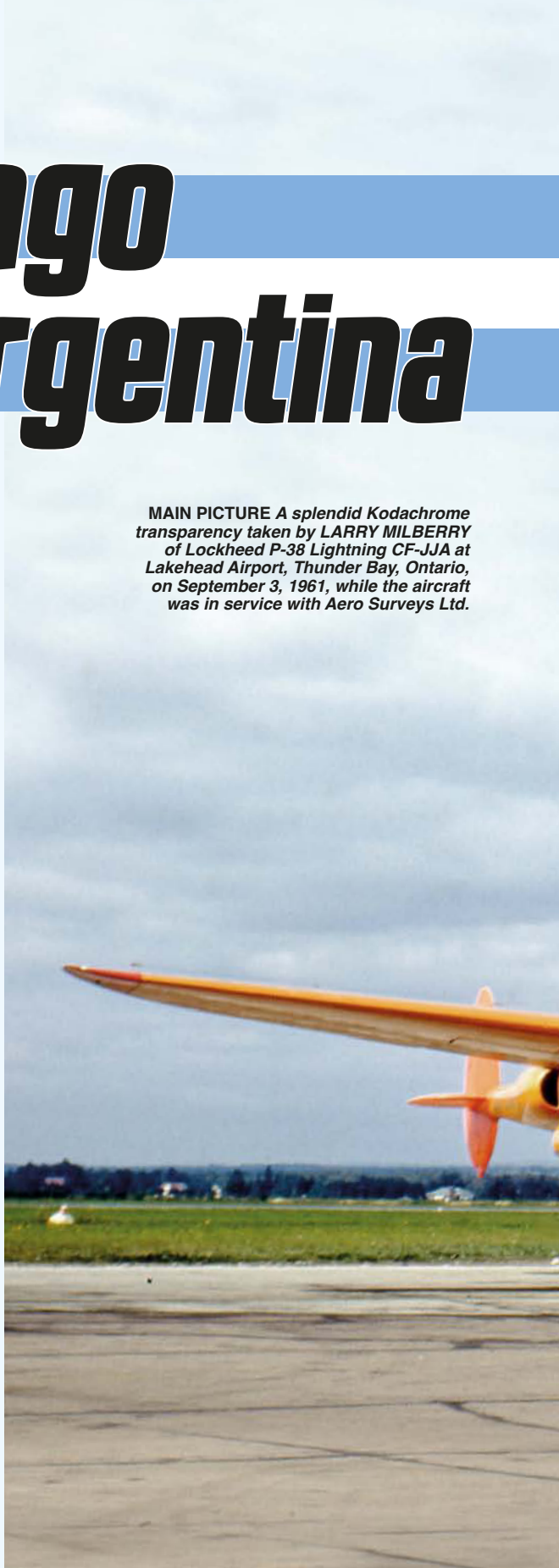
ON MAY 22, 1945, a US Army Air Forces (USAAF) ferry pilot was handed the logbook and papers for a newly-produced fighter which was to be delivered from the Lockheed factory in California to a military base in Arizona. The aircraft in question was Lockheed P-38L-5-LO Lightning c/n 8209 carrying the USAAF serial 44-27205.

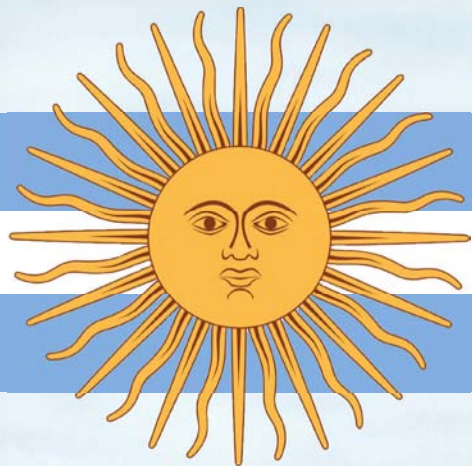
Such events were occurring constantly across the USA as military aircraft poured from the nation's factories — but there was nowhere for them to go. The end of the war in the Pacific was in sight (although few knew just how quickly and how violently it would end in August), so many warplanes were flown directly to storage yards or aircraft pools, where they were held in readiness in case they should be needed.

THE BEGINNING

After rolling off Lockheed's production line at Burbank, California, 44-27205 was flown to the Tucson Modification Center in Arizona the next day. These centres added the latest upgrades and changes to production aircraft so that the initial production lines would not be hampered by the various modifications.

MAIN PICTURE A splendid Kodachrome transparency taken by LARRY MILBERRY of Lockheed P-38 Lightning CF-JJA at Lakehead Airport, Thunder Bay, Ontario, on September 3, 1961, while the aircraft was in service with Aero Surveys Ltd.





RIGHT *The Lightning (relámpago in Spanish) in Argentina as LV-HIX, with pilot Miguel Fitzgerald in the cockpit with an Air Force corporal perched alongside. Although popular with its pilots, the P-38 was hard to maintain.*

FITZGERALD FAMILY COLLECTION





ABOVE & LEFT Originally serialled 44-27205, the P-38L was registered NX34992 in February 1946, this pair of photographs showing it in excellent condition some time after its civil registration had been applied to the rudders. Note the faired-over gun ports in the picture above. The machine was to be used only for "exhibition flying and racing".

KEVIN GRANTHAM VIA AUTHOR x 2

The aircraft remained at Tucson until July 5, when the gleaming combat-ready twin-boomed fighter was delivered to the San Antonio Air Technical Service Center at Kelly Field in Texas — where it was destined to remain longer than intended. When the war came to an end it stayed in storage while thousands of ex-combat aircraft were sold or scrapped.

On December 18, 1945, the surplus Lightning was delivered to Kingman Field in Arizona, where it was struck off the USAAF inventory and immediately turned over to the Reconstruction Finance Corporation.

During the war Kingman had been the main base for Western Flying Training Command's Boeing B-17 copilot school and the Flexible Gunnery Training School. It was also where surplus USAAF aircraft began arriving for storage on October 10, 1945. Soon as many as 150 a day were coming in; and, by December 31, some 4,693 combat aircraft were parked there, including 438 Lightnings. Many of these were brand new, with just factory-test and ferry time on the clock.

On January 31, 1946, 44-27205 was sold to Alfred F. Van Ness of Kerman, California, for \$1,250 and registered N57210, which on February 26 was changed to NX34992. The Civil Aeronautics Administration (CAA) issued Certificate of Airworthiness (C of A) No 34992 the

same day. The aircraft was registered in the EXPERIMENTAL category, certified for exhibition flying and racing only.

INTO SURVEY SERVICE

At the time several companies were interested in operating surplus combat aircraft as aerial mapping platforms, and P-38s were considered excellent buys. This was long before the term "warbirds" had come into being and these aircraft were simply viewed as surplus military aircraft. On March 10, 1947, the Lightning was sold to Fairchild Aerial Survey Inc of Los Angeles, California, for \$1,064.04.

Fairchild did not actively fly the aircraft, but kept it in a serviceable airworthy condition until March 1949 when the company modified the nose compartment by adding a new lower glass panel and a vertically-mounted Fairchild 224 9in x 9in aerial survey camera, a drift meter, intervalometer and a viewfinder for measuring groundspeed. The interior was fitted with a flatbed for the camera operator, which folded into a seat for take-off and landing, plus racks for the film magazines.

On completion of an overhaul, engine checks and modifications, the aircraft was registered in the RESTRICTED category, certified only for aerial photographic surveying but including essential cross-country flights to and from contract areas.



ABOVE A typical survey photograph, in this case of Niagara Falls, as taken by CF-JJA while in service in Canada with Aero Surveys Ltd. The company was a subsidiary of the Air Survey Company formed to provide detailed information of unmapped Burma and India in 1923, and which had itself become a subsidiary of Fairley in 1929.

No passengers other than crew members essential to the purpose of the flight could be carried.

In June 1951 Fairchild acquired a second Lightning, N21765, both aircraft undergoing conversion work that autumn at the company's main base at Burbank. The new arrival received the same basic modifications as N34992.

In October 1951 both aircraft were modified by extending the nose some 38in (965mm) to make room for three cameras. This modification was similar to the wartime Pathfinder adaptation of the P-38, and — surprisingly, given its blunt appearance — did not significantly affect the aircraft's performance.

The modifications to N34992 were completed by October 11, when it was test flown by Fairchild's chief test pilot, Vernon Raid Jr, on October 29, 1951. The aircraft remained within the RESTRICTED category and was certified only for aerial photographic surveying.

Four years later, in July 1955, Fairchild removed the metal nose and replaced it with a plastic nose to give the camera operator a modest forward view to help with navigation and positioning the aircraft for each photographic run. The aircraft was flight-tested with this new configuration on July 19, 1955.

Survey flying was, and remains, a very

Although the addition of a longer nose for camera installations marred the looks of the Lightning, performance was little affected and the aircraft served both California-based Fairchild Aerial Survey Inc and Aero Surveys in Canada well. LARRY MILBERRY





DOUG FISHER

ABOVE With fire extinguisher to hand, the engines of CF-JJA are started up before another photo-survey flight. The *Lightning* was painted in a distinctive orange colour scheme with Day-Glo red fins and propeller spinners, markings which were retained throughout its survey career, even after its move to its new air survey operators in Argentina.

demanding job. The objective of Fairchild's P-38s was to fly at around 34,000ft in order to produce mapping photographs scaled at one inch per mile (16mm per kilometre). At that altitude, the aircrew had to breathe pressure oxygen, a system which forces the gas into their lungs — in effect like “inverted” breathing. This, coupled with the severe cold at 34,000ft, tended to lessen the survey aircrew's efficiency.

The *Lightning* was equipped with a reasonably effective heating system, although distribution of the warm air was very localised. With outside temperatures as low as -60°C (-76°F), with lots of draughts and only the

unrelenting sun to heat the body, it was impossible for the crew members to keep uniformly warm. To solve this problem camera operator John Duffin devised a system whereby a small radiator was installed in N34992's nose section. This provided heat to the compartment via a parallel connection to one of the glycol return lines. Following modification, the *Lightning* was tested by Fairchild pilot Robert Peskensi on July 19, 1955.

On July 11, 1956, the aircraft changed hands again, this time going to Aero Surveys Ltd (also trading as Survey Aircraft Ltd) of Vancouver, British Columbia, Canada, for C\$34,000. The

Acquired by Servicios Aéreos Albarenque of Argentina in June 1960, this North American TB-25J was originally built as B-25J serial 44-31498 and was registered LV-GJX in Albarenque service. Its career was comparatively short, however, and it was derelict at Ezeiza by 1964 and finally broken up in March 1968.



JUAN C. CICALES VIA AUTHOR



ABOVE A rear port-side three-quarter view of CF-JJA in service with Aero Surveys Ltd. According to a census of air survey operators published in the February 14, 1958, issue of *Flight*, the company operated "two Ansons and one P-38". In total 12 P-38 Lightnings were operated on the Canadian civil register, the majority for aero-survey work.

company filed an application for entry on to the Canadian civil register and this was issued as CF-JJA the next day. The Department of Transport (DoT) issued C of A No 4351 on July 30, 1956.

SOUTH OF THE BORDER

In October 1961 the P-38 was sold to Kenting Aerial Survey for C\$15,000, only to be resold immediately to *Servicios Aéreos Albarenque* of Argentina. Albarenque had begun aerial survey operations with an Avro Anson V, LV-GJA (c/n 4117), and North American TB-25J Mitchell LV-GJX (c/n 108-37573).

By the end of 1960 the company had recognised the operational limitations of these aircraft and had begun looking for a turbo-supercharged twin-engined type which could be operated at around 35,000ft and which offered sufficient room for a vertical camera and an operator who could double as a navigator. The answer was found in the P-38, a type successfully employed in the aerial survey role, both by the USAAF during the war and by post-war American and Canadian civil operators.

On October 25, 1961, Albarenque applied for ferry registration for the P-38, which was issued as LV-PPY five days later, although it was not taken up, the aircraft undertaking its ferry flight as CF-JJA. After the completion of an overhaul, engine checks and a test flight, it was ready for the long trip to Argentina.

The aircraft finally departed on November 10, 1961, with Richard Wassell of Kenting at the controls. Its route was Buffalo—Raleigh—Durham—Miami—Kingston—Panama—Guayaquil—Lima—Arequipa—Antofagasta—

LOCKHEED P-38L LIGHTNING DATA

Powerplant 2 x 1,475 h.p. Allison V-1710-111/113 turbosupercharged liquid-cooled V-12 piston engines, each driving a counter-rotating three-bladed Curtiss Electric fully-feathering propeller

Dimensions

Span	52ft	(15.84m)
Length	37ft 10in	(11.53m)
Height	12ft 10in	(3.91m)
Wing area	327.5ft ²	(30.42m ²)

Wing loading at loaded weight	53.3lb/ft ²	(260kg/m ²)
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Weights

Empty	12,800lb	(5,806kg)
Loaded	17,500lb	(7,938kg)
Maximum take-off	21,600lb	(9,798kg)

Performance

Max speed at 25,000ft (7,620m)	414 m.p.h.	(666km/h)
Cruise speed	290 m.p.h.	(467km/h)
Landing speed	105 m.p.h.	(169km/h)
Stall speed (in fighter configuration)	67 m.p.h.	(108km/h)
Rate of climb	7min to 20,000ft (6,096m)	
Service ceiling	44,000ft	(13,411m)
Range normal	450 miles	(724km)
maximum	2,600 miles	(4,184km)
Fuel capacity normal	410 US gal	(1,552lit)
maximum	1,010 US gal	(3,823lit)

RIGHT *The rigours of aerial survey work resulted in the forging of close friendships between the crews at Albarenque, including this one photographed beside the P-38 at Bariloche. From left to right: Miguel Fitzgerald (pilot), Greco (navigator/camera operator) and Antonio Tomizzi (mechanic).*

BELOW *Built by Airspeed at Christchurch during the winter of 1947–48, de Havilland Mosquito B.35 LV-HHN (formerly VR794 and CF-HMK) was damaged beyond repair at Rio Cuatro, Cordoba, on November 22, 1963.*

CECILIA VIBERTI VIA AUTHOR



FITZGERALD FAMILY COLLECTION

Santiago de Chile. It finally arrived at the Aeropuerto Internacional de Ezeiza, Provincia de Buenos Aires, on November 24.

The company filed an application for entry on to the Argentinian civil register and this was issued as LV-HIX on February 13, 1962. The following day Wassell took the Lightning on a 90min local test flight. The *Dirección General de Material de Aviación Civil* issued C of A No 3882 the same day. The aircraft's RESTRICTED certificate directed that only a pilot and a navigator/camera operator could be carried during flights and that it was "Certified for Aerial Survey Only. Parachutes to be carried for each occupant. This is a military aircraft under civil aviation regulations and can not be used for transport of passengers or cargo". The Lightning's regular pilots were Donald Glass, an Argentinian-British pilot who had flown Consolidated B-24 Liberators with the RAF during the war, and Miguel Lawler Fitzgerald.

Albarenque conducted some initial survey missions later that year and proved that the P-38

was indeed capable of photographing large areas in a much shorter time than previously possible. The last C of A renewal for the Lightning was awarded on March 25, 1964, by which time the 19-year-old fighter had accumulated some 1,471hr 30min of flying time.

TO A NEW OWNER

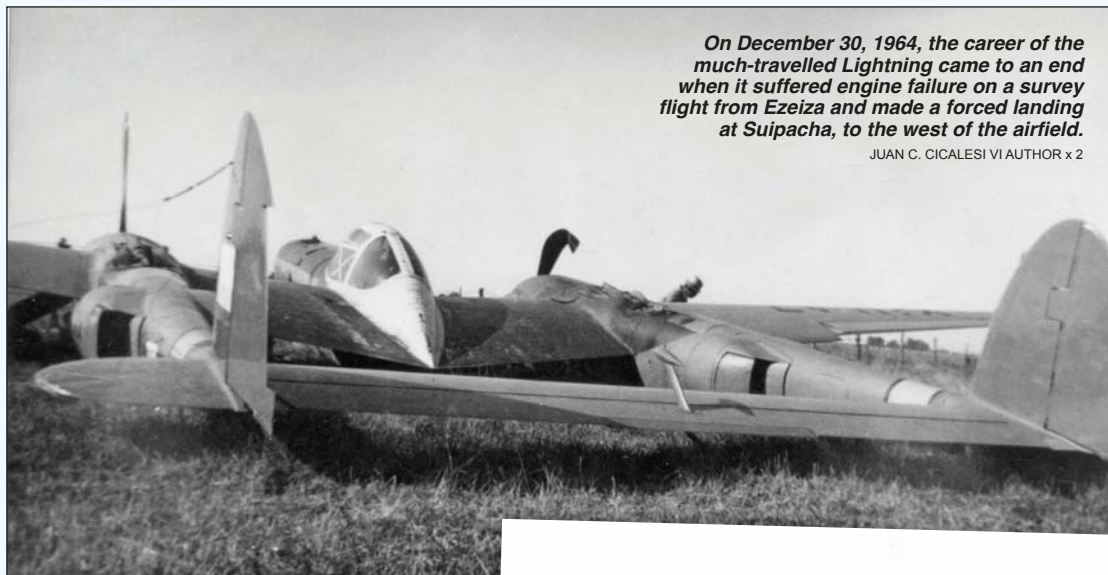
Early in 1964 *Spartan Air Services Sociedad Anónima*, the Argentinian branch of the Canadian firm, was looking for an aircraft capable of replacing de Havilland Mosquito B.35 LV-HHN, which had been damaged on November 22, 1963. Heavily engaged with contracts in Mendoza and San Luis provinces, Spartan opened negotiations with Albarenque to buy LV-HIX. On June 29, 1964, the company paid C\$28,000 for the machine and its Wild RC-8 camera. The Lightning was finally transferred to Spartan on August 20, 1964.

Spartan operated the P-38 for the next few months from El Plumerillo Airport in Mendoza province. Areas covered included the provinces



On December 30, 1964, the career of the much-travelled Lightning came to an end when it suffered engine failure on a survey flight from Ezeiza and made a forced landing at Suipacha, to the west of the airfield.

JUAN C. CICALES VI AUTHOR x 2



of Mendoza, San Luis and Neuquen, plus major surveys of the Andes on behalf of *Fabricaciones Militares*, the Argentinian procurement agency, as well as Shell and Esso.

Routine maintenance and the changing of filters, oil and hydraulic fluids etc was undertaken in the field, wherever the aircraft was hangared, either El Plumerillo or Ezeiza. The exposed film was sent to Spartan's offices in Buenos Aires where its development and interpretation were supervised by the *Fuerza Aérea Argentina* (FAA — Argentinian Air Force). If a military base appeared on the film the official censor intervened to determine whether the photograph could be used for commercial purposes. Spartan also maintained a project office in Mendoza.

LIGHTNING STRIKES

The P-38's operational career ended four months later. Early in the morning of December 30, 1964, Spartan pilot Julio A. Gaudin took off from Ezeiza airport on a ferry flight to Mendoza. A few minutes after taking off, the port engine failed, prompting Gaudin to reduce power and feather the propeller. The feathering system started to function properly, the tachometer reading dropping to zero. At this point the starboard engine also began to lose power. Having reported his situation to air traffic control at Ezeiza, Gaudin released the droptanks and made a wheels-up landing in a field at Suipacha, Buenos Aires, stopping a short distance from a fence. Gaudin escaped unhurt but Antonio Tomizzi suffered head injuries. By the time of the accident the P-38 had logged a total flying time of 1,566hr.

Despite its suitability for the work it had to perform the Lightning had proved to be a complex high-maintenance machine, expensive



ABOVE *The pilot of the Lightning, Julio Gaudin, skilfully brought the aircraft down in a field. This and the shortage of spares meant the scrapper's torch for a machine that had been built for war but which had proved itself a useful and reliable asset in peace.*

and challenging to run. Spare parts were scarce and therefore expensive.


The technical inspection following the forced landing reported that: "the aircraft lacked appropriate maintenance. The cause of the accident is attributed to failure of the port engine owing to a loss of glycol and the failure of the starboard engine to deficient spark plugs".

No attempt was made to make the Lightning airworthy again and it was declared beyond economical repair. Sadly, the airframe was towed away and sold for scrap.



ACKNOWLEDGMENTS

The author would like to thank Kevin Burge, Lynn Gamma, Julio A. Gaudin, Miranda Gilmore, Kevin A. Grantham, Larry Milberry, Raul Robatto, Robert M. Stitt and Terry Judge for their invaluable assistance



“The Skyhook is a perfect answer to man’s age-old quest for taking the shortest distance between two points. In a Skyhook you can gracefully climb up and over the congestion of a city or over bridgeless rivers with equally nimble ease . . .”

— Cessna CH-1 Skyhook brochure, 1961

MAIN PICTURE A superb photograph by JIM LARSEN of one of Seattle Helicopter Airways' Cessna CH-1C Skyhooks landing on a rooftop in the shadow of the city's brand new landmark, the Space Needle, during the 1962 Seattle World's Fair.

Cessna's Whirlybird

*By the early 1950s, Cessna had become one of the most prolific aircraft manufacturers in the world. The advent of the helicopter, combined with the company's experience and technical expertise, looked set to guarantee healthy profits from the development of a rotary-wing Cessna. Nothing is guaranteed in aviation, however, as **NICK STROUD** relates*



NO SMOKING

CESSNA — A WORD that brings to mind the classic two- or four-seat high-wing piston-engined monoplane used by flying clubs and training schools the world over. Or perhaps it suggests one of a long line of elegant twins with names like Golden Eagle or Chancellor, or even a compact business jet. The company formed by Clyde Vernon Cessna in September 1927 represents one of the world's most successful aircraft manufacturers, more examples of the Cessna 172 having been built than any other aircraft in history. What is less well known, however, is the company's foray into the world of rotary-wing development in the 1950s, resulting in an elegant record-setting helicopter of remarkable performance. So why did the innovative Cessna Skyhook ultimately end up being effectively erased from the company's corporate memory?

Charles Seibel – helicopter genius

In 1950 Dwane L. Wallace, President of the Cessna Aircraft Company, was hearing good things about the Seibel Helicopter Co, based, like Cessna, in Wichita, Kansas. Formed by former Bell and Boeing employee Charles Seibel in 1948, the company had developed several of Seibel's rotary-wing designs, including the S-3 and S-4, the latter incorporating a rotor system which



used stainless steel L-shaped blade attachments which carried the rotor loads and flexed for control input, thus eliminating the need for blade pitch bearings. Two S-4s were built for evaluation by the US Army, for which they were designated YH-24s. Although Seibel failed to gain the Army contract, Cessna's President was present at the ceremony to celebrate the Type Certification of the S-4 at Wichita Airport in April 1950, which would lead to a major change in the fortunes of the bright up-and-coming helicopter designer.

In January 1952 Wallace brokered a deal in which Seibel would become part of Cessna and two months later all Seibel equipment, including the sole S-4B, began the move to Cessna's Pawnee plant in Wichita. By the summer of 1952 the transfer of personnel and equipment was complete and, after familiarisation flights of the S-4B, registered N5154, by Cessna pilots (after which it was scrapped), work began on a brand new design — the CH-1.

The prototype was a flying testbed with no enclosed fuselage or cowling — but one major difference on the new machine was the forward mounting of the engine, which would offer advantages for installation and maintenance as well as providing good centre of gravity (c.g.) control. It would also, however, create longstanding headaches — literally — with how best to incorporate the exhaust system, which

ABOVE A publicity photograph of Charles Seibel in the mid-1950s.

BELOW The second prototype CH-1, N5156, demonstrates the type's versatility in a Cessna publicity shot. This aircraft was bare metal with emerald green upper surfaces and a tapering black cheatline which ran from the nose to the aft fuselage.

PHILIP JARRETT COLLECTION





ABOVE Another promotional shot of the second prototype CH-1, N5156. The first prototype, N5155, was originally built without the horizontal stabiliser on the aft fuselage and was much tested before one was fitted. All subsequent CH-1s were fitted with the stabiliser, which was modified a number of times during the type's development.

would be extremely loud and prone to burning the grass or runway on which the helicopter stood. Forward-mounted engines had been used on helicopters before; Sikorsky's S-55 of 1949, for example, used a large nose-mounted radial engine which enabled an exhaust collector to be fitted, which would route the exhaust up and away to be dumped overboard without scorching the grass or contaminating the cockpit. Cessna, however, was contracted to use only Continental horizontally-opposed engines for its products and the CH-1 was to be fitted with a super-charged 260 h.p. six-cylinder O-470 engine, so a different solution would have to be found for the new machine.

Work continued apace on the new design, with a quarter-scale model undergoing windtunnel tests at Wichita State University in 1952. Steve Remington, who joined the newly-minted Cessna Helicopter Division in September 1952, recalls the cramped conditions of the new project office: "The helicopter group was crammed in a second-floor office at the rear corner of the main Pawnee production plant. We overlooked the

small Cessna field, which was grass with a tiny runway aiming right at McConnell AFB; Boeing B-47s from the base noisily whizzed past our windows after take-off. Just below the office a tail rotor test rig whirled away night and day".

Adding the cladding

In July 1953 the skeletal CH-1 prototype, N5155, made its first hovering flights, before its distinctive external cladding, designed by Richard Ten Eyck, was added. Ten Eyck's design created the impression of a fixed-wing aircraft, the cabin behind a forward-mounted engine sweeping into a streamlined fuselage which had more in common with a light aircraft than its helicopter contemporaries. The second prototype, N5156, made its maiden flight in 1954 and was extensively test flown at Cessna's nearby Prospect plant.

Although the performance of the CH-1 was promising, the aforementioned exhaust problems were proving something of a challenge. Project Engineer Bob Smith remembers the earsplitting process of trying to find a solution to the noise issue:



ABOVE A pair of promotional Cessna photographs from 1955–56 emphasising the spacious cabin of the CH-1; the cockpit view on the left is probably a CH-1B. Note the hard-to-ignore drive shaft fairing between the front seats. **BELOW** Cessna Helicopter Division chief test pilot Jack Zimmerman flew Sikorsky R-4s during World War Two.

“[Test pilot] Jack Zimmerman complained about it right after the completed CH-1 started flying. Colleague Mel Vague and I went out to the tie-down area one afternoon to record sound readings and the temperature and humidity to correct the sound measurements. We didn’t have hearing protection in those days. Jack was right! It felt like someone was sticking needles in our ears! The dB level corrected to 141; the temp was 114°F [45°C] and the humidity was three per cent. Good old Kansas summertime. The dB level was way above the Fletcher-Munson curve, which showed the levels above which permanent hearing loss was probable. Right after that we started in earnest to design a muffler — I guess we never did get it right.”

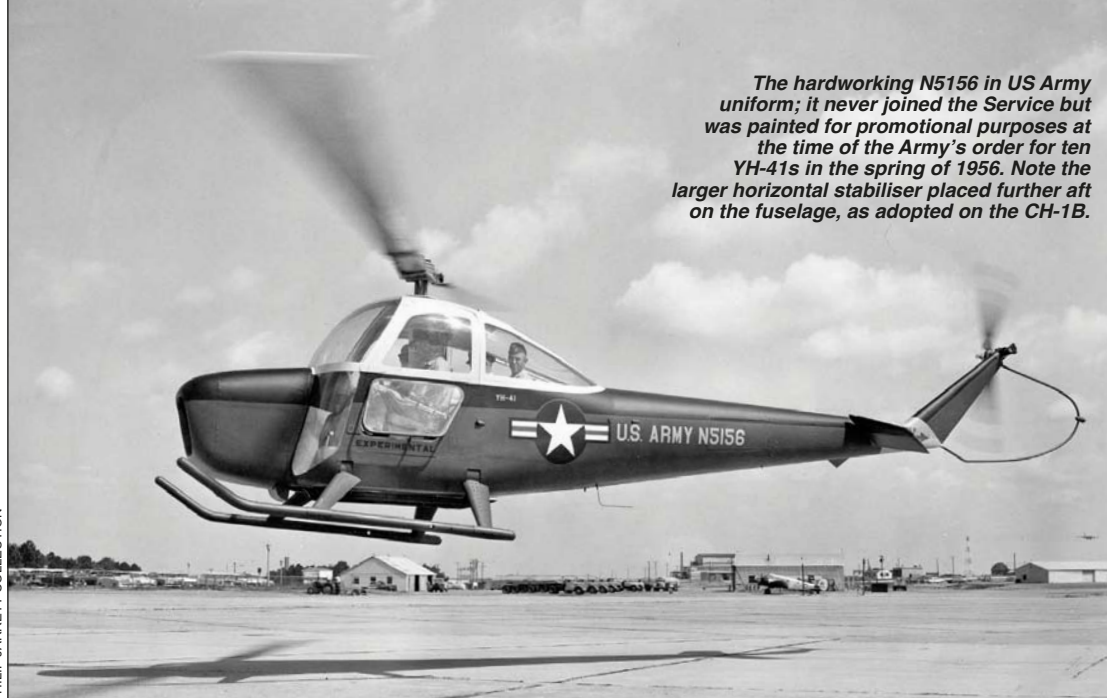


On June 9, 1955, the CH-1 received Type Certification 3H10, the helicopter having achieved some impressive figures during testing; at 122 m.p.h. [196km/h], the CH-1 had the highest never-exceed speed (v_{ne}) of any certificated helicopter in the USA and could also boast an exceptional hover ceiling of 11,000ft. Despite these promising achievements, however, the type was still subject to design issues, including difficulties with longitudinal stability caused by the pitching moment of the fuselage. The helicopter also suffered its first serious in-flight technical problem during a demonstration tour in June 1955, as Sid Shannon, Cessna’s Sales Manager at the time, recalls: “On June 21, on the last leg of a flight from

On September 13, 1955, Jack Zimmerman flew N5156 to Pike’s Peak in Colorado, where he flew the US Army’s Maj Gen John G. van Houten and Capt Knowles from nearby Fort Carson on a series of flights, one reaching 17,600ft.

VIA STEVE REMINGTON/WWW.COLLECTAIR.COM





The hardworking N5156 in US Army uniform; it never joined the Service but was painted for promotional purposes at the time of the Army's order for ten YH-41s in the spring of 1956. Note the larger horizontal stabiliser placed further aft on the fuselage, as adopted on the CH-1B.

Washington DC to Columbus, Ohio, the failure of the pitch arm caused a forced landing near the town of Cadiz, Ohio. I had been flying the helicopter until just a few moments before it pitched up and sideways very violently. Jack Zimmerman was fighting the controls but was having difficulty and after a few moments said he could not hold it and to get out.

"It took a moment to unbuckle the seatbelt, open the door and crawl out over the collective control stick [the passenger sat in the left-hand seat in the CH-1] on to the skid — during that time forward speed had diminished a great deal. I stood on the skid, holding the door open, looking at Jack. As the speed decreased some semblance of control returned and Jack said to get in and help find a spot to put down. Already being a member of the Caterpillar Club, I felt no need for a second membership and got back in and helped locate a landing spot."

Pike's Peak, BLC and the Seneca

After repairs the CH-1 continued on its tour, visiting military bases until its return to Wichita at the end of July. In September 1955 it was decided to highlight the CH-1's excellent altitude performance by taking it to the summit of Pike's Peak in Colorado, at 14,110ft one of the highest mountains in North America, for a series of high-profile trial flights. Accompanied by various members of the US Army brass, Jack Zimmerman landed, hovered and took off with two and three passengers and reached a height of 17,600ft. It was a promotional triumph, despite Bell putting a Model 47G on the same spot later the same day. Indeed it would become *de rigueur* for helicopter companies to use Pike's Peak to extol the virtues

Just a moment . . .

A PITCHING MOMENT (PM) is a rotational force acting around a specific point (usually the centre of gravity), which causes an aircraft to pitch nose-up or nose-down.

In a longitudinally stable aircraft, a small increase in angle of attack (AoA) will change the pitching moment to create a nose-down force which tends to bring the AoA back down again and return the aircraft to a state of equilibrium. Conversely, a small decrease in AoA will change the pitching moment to create a nose-up force, which again tends to even out the flightpath.

Anyone who has built a free-flight model aeroplane will know the importance of such stability, which is essential to keep the model aloft without any pilot input. If the pitching moment does not have a corrective effect, the model will deviate from stable flight. In a full-size aircraft, the lack of corrective effect can enhance manoeuvrability but can also lead to handling problems, as with the Skyhook.

PM depends on a number of factors, including the aerodynamic properties of the wing and tailplane such as wing section, shape and position; other factors include the application of power and/or flaps, the shape of the fuselage and anything attached to the wing, such as engine nacelles. **MICK OAKLEY**

of their products after the Cessna and Bell flights.

Around the same time, work commenced on the improved CH-1B, aimed at attracting military orders and incorporating the more powerful Continental O-526 engine and a larger constant-chord moving tailplane as well as other technical improvements. Work was also in hand on an active suction boundary layer control (BLC) system designed to delay the onset of retreating-



ABOVE Fitted with the more powerful Continental O-526 engine, the YH-41 Seneca entered service with the US Army in September 1957, 56-4237 being the first to be delivered after a series of acceptance flights made by Lt A. E. Lush. **BELOW** An extremely rare photograph of Capt James Bowman landing the heavily modified N5157 on its trolley (the undercarriage having been removed) following its record-setting high-altitude flight on December 27, 1957.

VIA STEVE REMINGTON/WWW.COLLECTAIR.COM

blade stall. On June 30, 1955, the CH-1 became the first — and only — helicopter ever to use a BLC system in forward flight. Tests were performed at 10,000ft, the type being one of the few helicopters with sufficient performance at altitude to undertake them, results showing a 13 per cent increase in speed. The system was ultimately deemed impractical, however, as the increase in weight and horsepower required for the BLC equipment were felt to outweigh the benefits of such a system.

In May 1956 good news arrived in the form of a US Army order for ten CH-1Bs for evaluation purposes, to be designated YH-41s, the deal being worth \$1.1m. The only sore point was that the Army had contracted Cessna for the helicopters

to be fitted with O-470s, but as the company had already decided to scrap the engine in favour of the O-526, Cessna was forced to pay the difference on the new engines and the associated engineering costs. The CH-1A prototype N5156 was accordingly painted in US Army markings and photographed for promotional purposes.

The ten YH-41s, given the serials 56-4236 to 56-4245, were all built at the Pawnee plant and were given the name Seneca for military service. The first to be delivered was 56-4237, which went to Edwards Air Force Base in California for preliminary testing in September 1957. The rest were sent to various Army test centres during 1957–58. Although the YH-41s performed well during evaluation trials, 56-4237 even being

“In December 1957 Capt James Bowman flew the CH-1 to an astounding 30,355ft, the tiny machine leaving a contrail in the blue Kansas winter sky”





LEFT & ABOVE The CH-1's instrument panel. CH-1Bs were fitted with an unusual airspeed indicator, the redline maximum speed being adjustable in flight, based on gross weight and altitude. This was replaced by a standard indicator on the CH-1C, as seen in the top left of the panel in the picture above.

involved in the rescue of a fallen horse-rider who needed to be evacuated from a steep slope surrounded by tall pines, no further military orders were forthcoming, the type still suffering from stability and control problems. Some YH-41s continued to operate into the 1960s, but most were scrapped or bought back by Cessna. The sole surviving Seneca, 56-4244, is currently in storage at the US Army Aviation Museum at Fort Rucker, Alabama.

A new world record

Always with one eye on promotional activity, Cessna decided to increase its standing further with the military by taking on the world absolute altitude record for helicopters, the CH-1's performance having proved excellent at height. The current record was held by France's Sud Djinn, which had reached 27,830ft [8,483m] in March 1957. In September 1957 Steve Remington put forward a detailed proposal to establish a new world altitude record for helicopters with a specially modified CH-1B. He recalls:

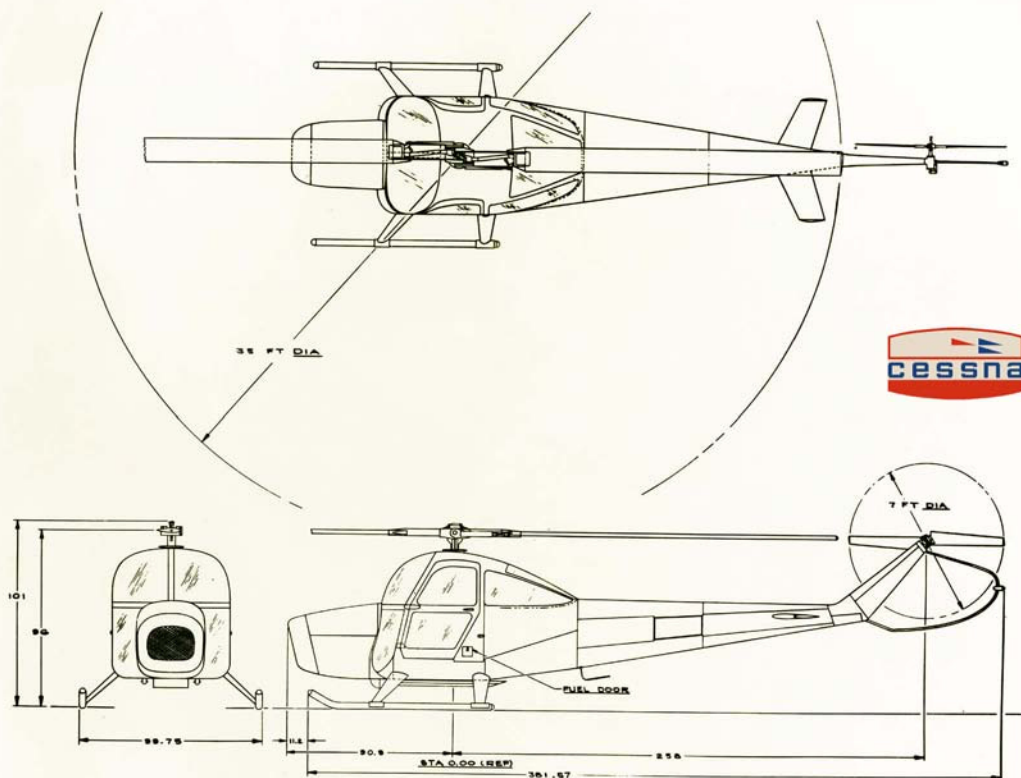
"The helicopter was stripped of nearly everything that wasn't essential for flight or pilot safety. The final configuration was to be flown off a special dolly; approximately 266lb [120kg] was removed with about 27lb [12.25kg] added including ballast. I was assisted on the project by two other flight test engineers, Frank Robinson [of R22 and R44 fame] and John Parks. We were all under the age of 27."

Following trial flights of the modified N5157 on December 18, 1957, Capt James Bowman of the US Army Aviation Board flew the helicopter from Wichita Airport to an astounding 30,355ft [9,252m] on December 27, the tiny machine leaving a contrail in the blue winter sky over Kansas. The flight was homologated by the *Fédération Aéronautique Internationale* as reaching

29,777ft, although Steve still disagrees with this reading to this day: "We had established an altimeter error of less than 29ft [8.8m] at the altitude and airspeed attained". Nevertheless, it was still a new world record. Rather cannily, Bowman was posed alongside a standard YH-41 for photographs, giving the impression that it was in this machine that he had made the record flight.

In January 1958 all Cessna Helicopter Division jigs and production equipment were moved to the Wallace plant, yet another of Cessna's Wichita factories, and work began on finding solutions to the CH-1's stability and control problems. This work resulted in the CH-1C, which would become the model for the civilian production version, to be named Skyhook, in line with Cessna's policy of prefixing "Sky" to its aircraft — Skyhawk, Skyknight, Skywagon etc. After the installation of gyro devices and a larger 9ft-span tailplane to enhance stability, the CH-1C was issued its Type Certificate on July 28, 1959, the prototype, N5159, having done a great deal of test flying. At the same time a modified YH-41, 56-4236, was certified for flight under instrument flight rules (IFR), the first helicopter to obtain such certification, the Cessna team virtually writing the rulebook on helicopter IFR operations.

October 1960 saw the public unveiling of the CH-1C Skyhook at Wichita Airport, and within a month more than 70 demonstration flights had been given to prospective customers. Production commenced at the Prospect plant. Tests of the CH-1C with a view to an order for an instrument trainer were undertaken at NAS Patuxent River by the US Navy, which elected to order the Bell HTL-7 instead. By the end of 1960 Cessna had been investing in its helicopter division for the best part of a decade, with precious little to show



PHILIP JARRETT COLLECTION

ABOVE A simple promotional three-view drawing of the YH-41. In 1958 American model kit manufacturer Adams Action Models released a 1/48th-scale model of the YH-41 "Missile Transporter", which came with a pair of MIM-23 Hawk surface-to-air missiles to mount on the rear fuselage. This would of course have been disastrous in real life!

for it other than a small military order and some albeit impressive world records. For the company's rotary-wing department to survive, the Skyhook would have to do some brisk business and prove itself as a sustainable and profitable element of the Cessna combine.

Further setbacks

With production of the CH-1C in full swing the company announced that the Skyhook would cost \$79,960, with the first examples being available from 1961. Customer support would be provided through the usual Cessna agents, *Flight* remarking in its November 11, 1960, issue, that for the UK this would be Airwork, at that time based at Booker (although in the event no Skyhook was ever imported into the UK).

Desperate for some form of return from its helicopter investment Cessna pursued the US Army's Light Observation Helicopter (LOH) programme in early 1961, building a mock-up of the CH-4, in which the engine was relocated behind the cabin's rear seats. Again, Cessna lost out, Bell and Hiller winning LOH contracts in

May 1961. More bad news had arrived the previous month when Cessna Marketing Division pilot Oliver Hopkins was killed while flying the CH-1C during a demonstration tour of Texas. It is believed that the sealed shaft to the tail rotor snapped, causing the tail rotor to break off, the suddenly nose-heavy machine plunging to the ground. Reportedly a YH-41 crashed into a steelyard in Albuquerque, New Mexico, around the same time, although it is thought this was not because of a technical malfunction and the report remains unconfirmed.

Deliveries of the Skyhook began in the autumn of 1961, Cessna's typically slick advertising campaign having generated promising sales and interest. As a contemporary sales card for the Skyhook explains:

"The Skyhook is a perfect answer to man's age-old quest for taking the shortest distance between two points. In a Skyhook you can gracefully climb up and over the congestion of a city or over bridgeless rivers with equally nimble ease". It continues: "If you're involved in production you can go from plant to plant . . . if

One of the Seattle Helicopter Airways (SHA) Skyhooks works the crowds at the Seattle World's Fair, also known as the Century 21 Expo, during April to October 1962. The fair represented an excellent promotional opportunity for Cessna to extol the virtues of vertical flight in urban landscapes, and SHA's fleet of CH-1Cs did a roaring trade during the six-month show. Photograph by JIM LARSEN.





ABOVE Production CH-1C Skyhook N5746 “four up” over Wichita in a slight variation of the production colour scheme. Note the large horizontal stabiliser, which is of constant chord, in contrast to that of the YH-41, which had a swept leading edge.

RIGHT A previously unpublished photograph of one of the UH-41As sent to Iran as part of the USA’s Military Assistance Program. It is believed that five examples served in Iran, although this is unconfirmed.

FARZIN NADIMI VIA STEVE REMINGTON



you’re in merchandising you can go from store to store . . . and if you’re in sales you can go from door to door . . . and all directly . . . without wasting so much as a minute, a step or a penny in unnecessary travel time, effort or money!”.

Foreign sales – sort of

In 1962–63 a number of CH-1Cs were sold to the US Army Transportation Materiel Command for use in the USA’s Military Assistance Program (MAP), these being given the serials 62-5845–5848, 62-12350, 63-9793 and 63-8067–8071 (making a total of 11 machines, although in a 1991 interview Charles Seibel referred to “about 15”). Several of these machines were sent to Iran, where they were used by the Iranian Gendarmerie Aviation Unit for observation and utility purposes. It is not clear exactly where the remainder went, although it is believed that four served with the military in Ecuador, and that two may have gone to Peru.

Civil sales of the Skyhook began to roll in, with more than 20 on the order books by 1962. The


CH-1C was displayed alongside its rivals from Hiller and Bell at the 14th Annual Helicopter Association of America Convention in Dallas, Texas, in January of that year and three Skyhooks were memorably operated by Seattle Helicopter Airways from rooftops during the 1962 Seattle World’s Fair, reportedly carrying some 10,000 passengers during the six-month event, which ended in October.

Also in October a Skyhook was lost in the Gulf of Mexico with the loss of four lives. The helicopter, which had been fitted with floats, is believed to have suffered engine failure, which became something of an issue with Skyhook operators. Max Sonnenberg acquired a CH-1C as the flagship for his company, Sky Hook Inc, for use as an agricultural spraying machine in Colorado. In less than 200 flying hours Sonnenberg suffered six engine failures, the last leading to an autorotation on to a golf course, after which he dumped the Skyhook in favour of a more reliable Bell 47.

Down to earth with a bump

In an attempt to remedy these engine issues and finally iron out the Skyhook's stability and control problems, development of the CH-1D was put in hand for 1963. The new variant would be fitted with a new driveshaft to absorb torsional vibration, a rotor brake, a new Continental "Whirlaway" engine with strengthened con-rods and bolts, and a new collector exhaust system which ran along the underside and into the tailboom (which did little to alleviate the exhaust problem). With these palliative measures incorporated, the CH-1D was certificated on December 24, 1962, with a view to a bright 1963 in terms of sales. It was not to be. Just two days after the certification of the CH-1D, the entire Skyhook project was cancelled. On January 3, 1963, *Flight* reported the following:

"On December 26 Cessna Aircraft Co announced that it was discontinuing production of the Skyhook helicopter. Cessna President Mr Dwane Wallace states that, 'while the market for business and utility helicopters may develop into one of greater potential in the future, we do not feel the programme can continue to be sustained on the commercial business presently available'."

Cessna bought back all civil CH-1s in order to avoid design liability and servicing commitments, and all were scrapped at Wichita. Those obtained for use in the MAP continued to be sent abroad through 1963, but Cessna's foray into rotary-wing flight was over. Blighted by poor timing, recurring engine and stability problems, lack of civil and military sales and possibly the increasing notion of a poor fit within the company, the Skyhook was struck from the Cessna inventory and ultimately airbrushed from its history — an ignominious end for the innovative, and stylish, Skyhook. 

Cessna CH-1C data

Powerplant 1 x 270 h.p. Continental FSO-526A horizontally-opposed six-cylinder piston engine

Lifting rotor diameter	35ft	(10·67m)
Blade chord	13in	(33cm)
Disc loading	3·22lb/ft ²	(15·72kg/m ²)
Tail rotor diameter	7ft	(2·13m)

Dimensions

Fuselage length	32ft 8in	(9·95m)
Overall length	42ft 8in	(13m)
Fuselage width	5ft 4in	(1·63m)
Overall width	8ft 4in	(2·54m)
Height		
to top of cabin	7ft 2in	(2·18m)
of rotor	8ft	(2·44m)
overall	8ft 5in	(2·56m)

Weights

Empty (standard)	2,065lb	(937kg)
Maximum gross	3,100lb	(1,406kg)

Performance

Maximum speed	122 m.p.h.	(196km/h)
Cruising speed	90 m.p.h.	(145km/h)
Rate of climb	950ft/min	(290m/min)
Hovering ceiling		
at 2,700lb (1,225kg)	13,500ft	(4,115m)
Range		
normal fuel	260 miles	(418km)
with auxiliary tanks	400 miles	(644km)

ACKNOWLEDGMENTS

The Aviation Historian would like to thank Steve Remington and Jim Larsen for their invaluable help with the preparation of this article. For much more on the Skyhook and other aviation-related goodies, see Steve's CollectAir website at www.collectair.com

Every home should have one — the second prototype CH-1, N5156, in yet another colour scheme, demonstrates the helicopter's ability to transport passengers direct to the doorstep of a residence or country club. Despite Seibel and Cessna's best efforts the Skyhook was a doomed concept and has virtually no profile in the company's official history.



Dux-built Nieuport 17s of the Imperial Russian Air Service in an abandoned hangar sometime after the October 1917 revolution.

BEFORE & AFTER

ROGER TISDALE and ARVO VERCAMER continue the series in which they profile both the original and new markings of aircraft that have fallen into new hands. Next up — a Nieuport 17 that served with White Russian forces before becoming Estonian

IN THE AFTERMATH of the Estonian War of Independence (1918–20), in which Estonian forces fought Russian (Soviet and White) and German troops in a struggle to retain the nation's sovereignty following World War One, the Republic of Estonia was founded following the Tartu Peace Treaty in 1920.

Much of the retreating White forces' equipment was seized by Estonia, including seven Nieuport fighters. In Estonian service they were numbered 42, 43 (these being Nieuport 24Bis), 44, 45, 46 (Nieuport 17s) and 51, 52 (Nieuport 10s). The 17s appear to be part of a batch of 50 built by Dux at its Moscow works during 1917–18. Initially used by the Imperial Russian Air Service, many of them by 1919 were being flown by White Russian forces.

The aircraft illustrated, Nieuport 17 c/n 1797, fitted with 110 h.p. le Rhône engine No 776, was transferred by rail to Tallinn, where it was reassembled and test flown in March 1921 at Lasnamägi airfield. By June 30, 1921, a new le Rhône, No 5140, had been fitted and the aircraft was declared ready for service in the *Eesti Õhukaitse* (Estonian Air Defence Force). Records show that it was assigned to pilot Päev with Lüll as his mechanic.

While other Estonian Nieuports were lost in accidents No 46 remained in service, being assigned to pilots Kahn in 1923 and Stunde in 1924. Its engine was replaced in May 1923 by le Rhône No 5800. On June 1, 1925, the aircraft was placed in a reserve squadron before being removed from service by the end of that year.



A pilot of the Estonian Air Defence Force poses proudly beside Nieuport 17 c/n 1797, which was given the number 46 following its seizure from the Imperial Russian Air Service.

RIGHT The Russian orthodox cross insignia often applied to White Russian aircraft



Variations in style of Imperial Russian Air Service roundels

ABOVE Before: a typical Dux-built Nieuport 17 in Imperial Russian Air Service markings, as used by White Russian forces during 1919–20

LEFT Light blue variant of the Estonian national insignia used during 1920–21

The aircraft's c/n was recorded on the underside of the wings and tailplane

1797
TYPE 17

ABOVE Two variants of the upper wing national markings

RIGHT Plan (top) and side views of the Vickers machine-gun

Nieuport 17 c/n 1797 was seized from the retreating Russian White Army forces on January 1, 1920, after which it was flown by the Estonian Air Defence Force until the summer of 1925. It was fitted with a single Vickers machine-gun

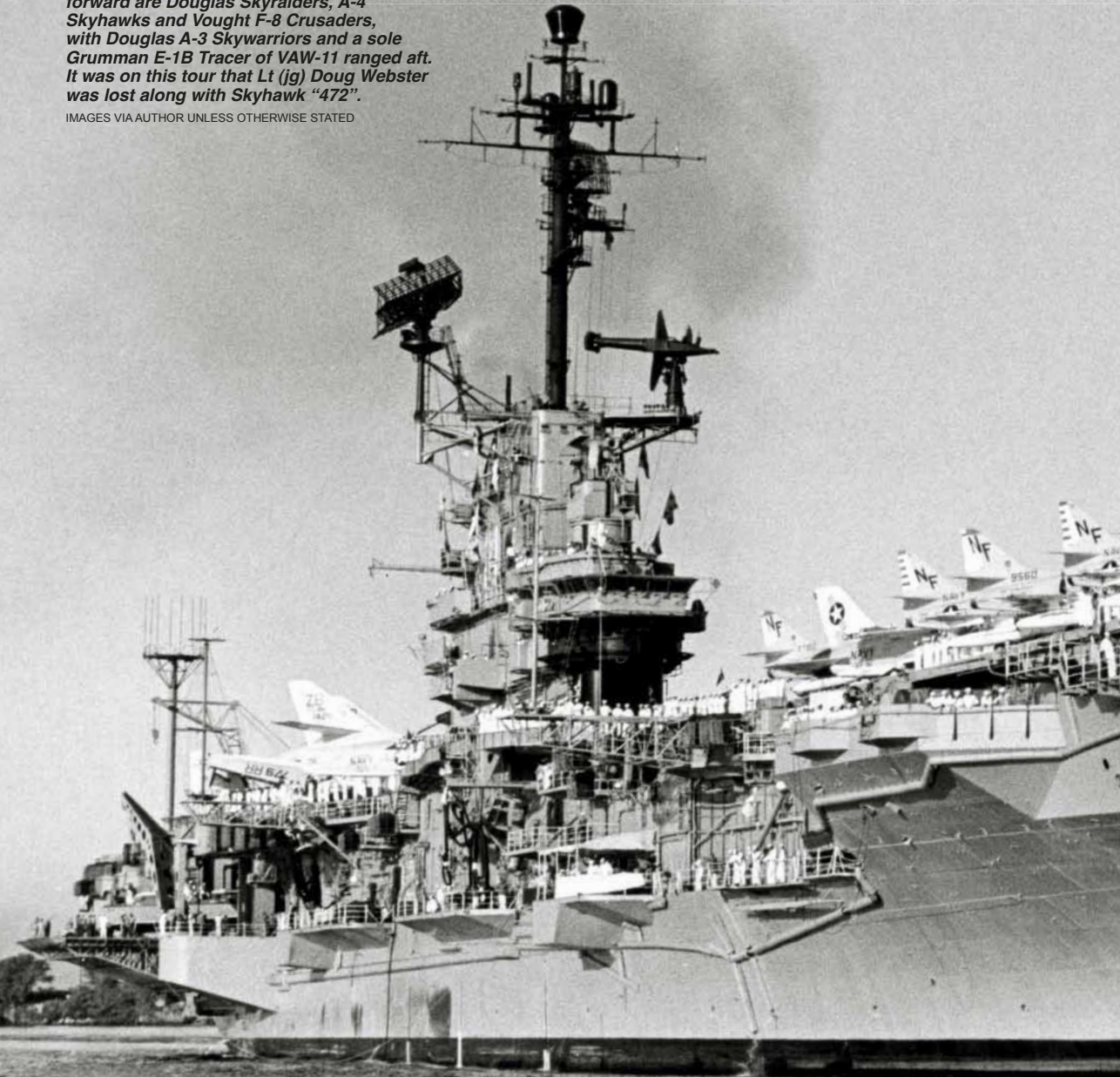
As with the triangular national markings on the top of the upper wings, some Estonian Nieuports had these markings painted full-chord on the underside of the upper wings

BROKEN ARROW:

TICO'S SOUTH-EAST ASIAN SECRET

The USS Ticonderoga departs Hawaii for its WestPac on October 9, 1965. Ranged forward are Douglas Skyraiders, A-4 Skyhawks and Vought F-8 Crusaders, with Douglas A-3 Skywarriors and a sole Grumman E-1B Tracer of VAW-11 ranged aft. It was on this tour that Lt (jg) Doug Webster was lost along with Skyhawk "472".

IMAGES VIA AUTHOR UNLESS OTHERWISE STATED



December 1965: the *USS Ticonderoga* steams away from the coast of Vietnam for Japan after a period of operations in support of the escalating conflict in South-east Asia. A routine arming exercise goes terribly wrong, leaving a pilot dead and an A-4E Skyhawk with a live thermonuclear weapon at the bottom of the Philippine Sea. Using previously unpublished material **JIM WINCHESTER** investigates a trail of secrets and lies at sea

DURING THE HEIGHT of the Cold War, when both American and Soviet forces were at states of constant high nuclear readiness, accidents involving atomic weapons were more common than generally supposed, most involving USAF Strategic Air Command's heavy bombers. The US Navy also suffered "Broken Arrows" — the code for accidental loss or destruction of a nuclear weapon — in the 1960s, but mostly in submarine accidents.

Only one incident involved the loss of a complete US Navy air-launched weapon. How it came about is a story involving secret international agreements, possible sabotage, cover-ups at many levels, outright lies and even the suggestion of murder.

In 1965 American involvement in Vietnam had

not yet peaked. The modernised *Essex*-class attack carrier *USS Ticonderoga* (CVA-14) had launched the first strikes against North Vietnam in the Tonkin Gulf Incident of August 1964. Returning to Alameda, California, on December 15 the same year the "*Tico*" underwent a period of overhaul until June 1965 and conducted air wing exercises before departing San Diego for Pearl Harbor, Hawaii, on September 28. There the carrier passed its Operational Readiness Inspection (ORI), the final hurdle before venturing on a WestPac, or western Pacific cruise, which from 1964 to 1972 inevitably meant action over Vietnam. Embarked was Carrier Air Wing Five (CVW-5), officially tasked as an "Attack Carrier Air Wing for support of conventional and nuclear war in all weather conditions".





The *Ticonderoga* “in-chopped” to Dixie Station, the carrier-operating area off South Vietnam, on November 5. Fresh carriers were eased into combat by flying missions over South Vietnam, where the threat was largely small-arms fire and light anti-aircraft artillery (AAA), rather than the heavy guns and MiGs found over the north — plus, since July 1965, the new SA-2 *Guideline* surface-to-air missiles (SAMs).

THE CHAMPIONS

The most capable of the *Tico*’s three light attack squadrons was VA-56 — “Champions” — flying the Douglas A-4E Skyhawk. The unit’s own stated mission for the 1965–66 cruise was “to conduct offensive air-to-surface operations with conventional and nuclear weapons”. So, despite a “hot” conventional war in Vietnam, the chance of a full-scale conflict with the Soviet Union or China was not far from the minds of the admirals in San Diego and Washington.

One of the newer VA-56 pilots was Lt (Junior Grade) Douglas Morey Webster of Warren, Ohio, who had received his Wings of Gold as a naval aviator under the Naval Aviation Cadet (NAVCAD) programme in 1964, and was quickly assigned to VA-56, destined for Vietnam. It appears that Webster soon became unhappy with the conduct of the war and with the Navy in general, and was saying as much in his letters home. He also wrote in his diary that the Vietnam situation was more serious and a far greater number of pilots were being lost than the American people were being told. Air Wing Five was spending more than half its flying exercises conducting nuclear war drills and it seemed as if



the essential exercises for conventional missions were “. . . being conducted during the intervals”, he wrote.

Described as “cheerful and likeable” by the sailors in the *Tico*’s W Division, responsible for the ship’s nuclear weapons, 24-year-old Webster was an accomplished high school and university gymnast. He had married his college sweetheart Marsha only shortly before the *Tico* sailed for Vietnam.

On November 21, 1965, the *Ticonderoga* moved north. Air Wing Five took part in raids on the Me Xa and Ha Chan bridges, the bridge complex at Hai Duong and on the Uong Bi thermal power station, Lt (jg) Doug Webster flying 17 operational missions. On December 2 the *Tico* pulled out of the line and headed for Yokosuka in Japan for a period of rest and replenishment. The transit to Japan itself was not a rest period for the crew, however, as nuclear war exercises continued.

At daybreak on Sunday, December 5, 1965, the *Ticonderoga* was steaming at 20kt on a heading of 049°, or roughly north-north-east, in company with four destroyers providing a circular screen. The weather that morning was rough, with water breaking over the bow, but by early afternoon was described as clear and sunny and the sea calm with occasional rolling waves.

As well as the conventional bombs, rockets and missiles employed against North Vietnam and the Viet Cong, CVW-5 carried a stockpile of much deadlier B43 thermonuclear weapons. The training version of the B43, used on shore-based exercises and in port, was not carried on cruise for space reasons, so on December 5, each aircraft participating in the day’s exercise was to be fitted with



ABOVE LEFT Plane Captain George Floyd poses beside what is believed to be A-4E BuNo 151022, the aircraft in which Doug Webster was lost on December 5, 1965. Taken the year before the accident, this photograph shows the Skyhawk when it was numbered "406" and was the regular mount of VA-56 officer Lieutenant Job O. Belcher.

ABOVE RIGHT Douglas Morey Webster was born on July 26, 1941, and is seen here receiving his pilot's wings on December 5, 1964. Webster was a new hand aboard the Tico for its 1965–66 tour and reportedly voiced misgivings about the purpose and prosecution of the conflict in Vietnam. Webster flew a total of 17 missions from the Tico.

a War Reserve, or live, weapon with an explosive yield of one megaton — about 67 times that of the Hiroshima bomb.

LIVE NUCLEAR WEAPONS

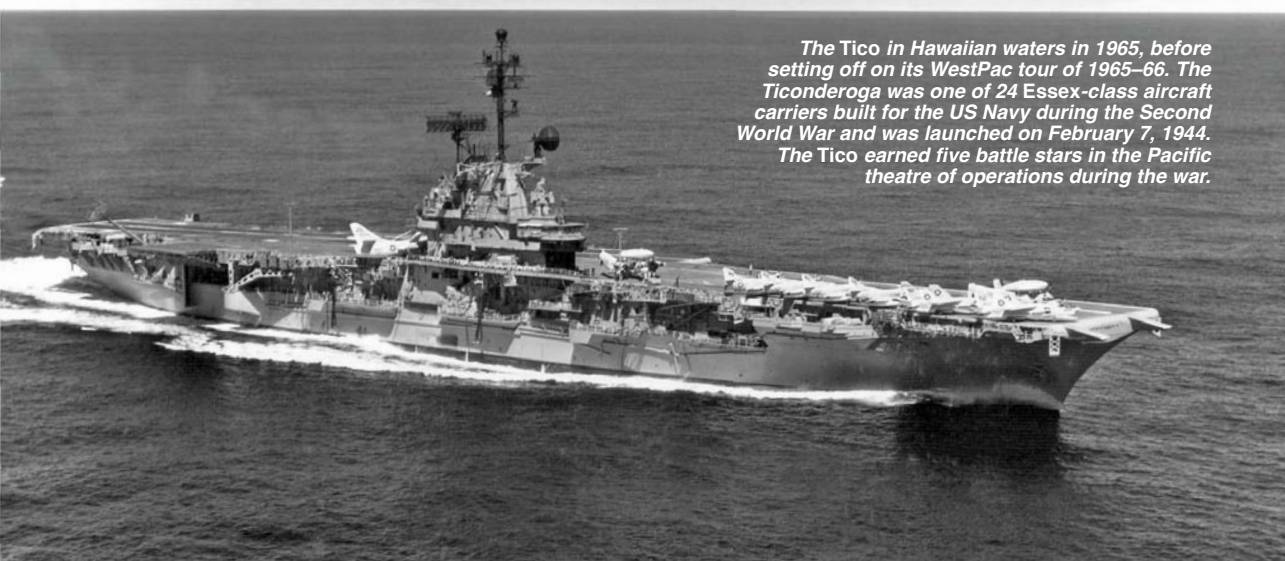
At 1300hr the codeword *Crewcut* was broadcast over the ship's loudspeakers, calling sailors to man their stations for a special (nuclear) weapons loading exercise. It was not on the posted Plan of the Day so for most of the crew it was a no-notice event, but W Division had been preparing for it since the *Tico* left Vietnamese waters. An electrical fire at 1335hr in an engineering space briefly delayed pro-

ceedings. The bridge was told the fire was out by 1341hr and all crew were at their stations by 1358hr.

The object of the exercise was to load all the aircraft in 30min and simulate their launch on a nuclear strike mission. The procedure was to arm the aircraft on the hangar deck, tow them to the No 2 elevator situated at the forward end of the angled deck, raise them, then tow them forward to the catapults. Instead of a catapult launch, they would sit there for a minute or so then go further forward to the No 1 elevator on the centreline and down again to the hangar deck for de-arming. A pilot was not actually necessary for this evolution,

"AT 1300HR THE CODEWORD *CREWCUT* WAS BROADCAST, CALLING ALL SAILORS TO MAN THEIR STATIONS FOR A SPECIAL NUCLEAR WEAPONS LOADING EXERCISE . . ."

The Tico in Hawaiian waters in 1965, before setting off on its WestPac tour of 1965–66. The Ticonderoga was one of 24 Essex-class aircraft carriers built for the US Navy during the Second World War and was launched on February 7, 1944. The Tico earned five battle stars in the Pacific theatre of operations during the war.





DENNIS PALMER VIA AUTHOR

ABOVE LEFT Commander William G. Nealon (furthest left) relieves Cdr Wesley L. McDonald (right) of the command of VA-56 in March 1965 as Cdr Macon S. Snowden, the commander of Carrier Air Wing 5, looks on. Allegations of tension between Webster and Nealon were made after the accident, although this remains pure speculation. **ABOVE RIGHT** Pilots of VA-56 pose beside a Skyhawk during a weapons training exercise at NAS Fallon, Nevada, just before the unit's deployment aboard the USS Ticonderoga in 1965. Webster is not among the group.

so on many jets a sailor in the cockpit rode the brakes as the aircraft was moved, aided by others carrying chocks who would throw them in front of the wheels when needed.

SKYHAWK OVERBOARD!

The first aircraft in line, A-4E BuNo 151022, callsign "Champion 472", was pushed by blueshirts (regular sailors) from its spot in hangar bay No 2 to the weapons elevator with Plane Captain Bob Redding on the foot-operated brakes, although he later told his shipmates that "it had no brakes". All the other A-4s were towed across the hangar deck by tractors, but in this case the tractor was waiting above on the flight deck. The B43 was loaded on the A-4's centre-

line pylon by armourer Paul Pizzarella of VA-56.

Just then, to the surprise of Bob Redding — who was now out of the jet and holding the boarding ladder — a fully kitted-out pilot appeared. Doug Webster had been ordered to man "472". He climbed aboard and strapped in. The armed A-4E was pushed backwards by many hands on to the elevator, followed by two sailors with U-shaped wooden chocks and at least three safety supervisors.

The sea was now (at 1450hr) a little rougher than before and at this moment some recall a loud-speaker announcement: "Standby for roll to port". The ship heeled and the A-4 began to roll backwards. The safety director blew his whistle to tell the pilot to "hold brakes". Randy Wilson of VA-56,

Skyhawk "402" of VA-56 catches the wire on the Tico in February 1964, just before the carrier departed for its 1964 WestPac tour and the Champions' first Vietnam combat cruise. The unit wore NF tailcodes from June 1956 until July 1966, when the unit joined Carrier Air Wing 9 and changed to NG tailcodes..

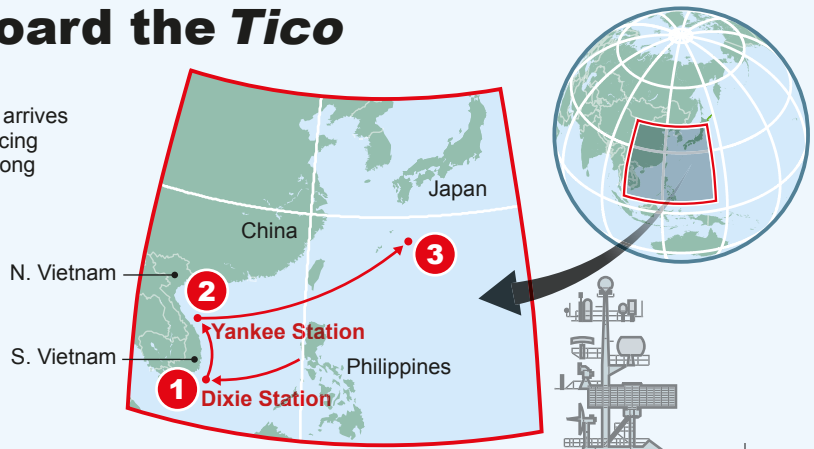
US NAVY VIA SKYHAWK ASSOCIATION/WWW.A4SKYHAWK.ORG



Tragedy aboard the *Tico*

Prelude to disaster

- 1 Nov 5 1965** *Ticonderoga* arrives at Dixie Station, commencing operations against Viet Cong targets in South Vietnam
- 2 Nov 21** Carrier moves to Yankee Station to conduct operations against North Vietnamese targets. On Dec 2 the carrier heads for port in Japan
- 3 Dec 5, 1300hr** En route to Japan, a *Crewcut* exercise commences



The *Crewcut* exercise procedure

-
- 4** Initially, Skyhawks of VA-56 are arranged on the hangar deck
 - 5** Each A-4 is loaded in turn with a live B43 nuclear weapon, then moved to the No 2 elevator
 - 6** Raised to the flight deck the aircraft are towed to the catapults, simulating a launch
 - 7** Aircraft are returned to the hangar deck via the No 1 elevator and de-armed

The incident of Dec 5

-
- 8** Skyhawk 472 is pushed to its loading point, loaded with a B43 and, with the pilot, Lt (jg) Webster taking the place of a Plane Captain in the cockpit, is pushed by crew members to the No 2 elevator
 - 9 1450hr** The ship heels to port and the aircraft starts to roll backwards despite a signal to "Hold brakes"
 - 10** Two chock men throw chocks behind the mainwheels but the starboard wheel slides and the port chock is knocked aside
 - 11** The aircraft tips backwards, falls into the ocean and sinks rapidly in 16,000ft of water



A quartet of VA-56 "Scooters" during an exercise. Curiously, the example furthest from the camera is uncoded and without the unit's distinctive rudder flash. The A-4E introduced the more powerful Pratt & Whitney J52 engine as well as greatly improved avionics, including a toss-bombing computer.

US NAVY VIA SKYHAWK ASSOCIATION



GREG GOEBEL

SMALL BOMB, BIG IMPACT

THE B43 WAS developed as a low-drag parachute-retarded shock-resistant variable-yield nuclear bomb for high-speed low-altitude delivery, work beginning on the weapon at the Los Alamos National Laboratory in 1955. Originally designated TX-43, the bomb was intended to fulfil two distinct requirements, the first being the penetration of hard targets and the second the classic airburst method of delivery. For the former a special nose, designated Mod 0, incorporating a steel spike to penetrate a hard surface before a delayed surface burst, was fitted, the alternative Mod 1 nose carrying an airburst radar-fuzed system. The weapon's explosive yield varied from 70 kilotons of TNT to 1 megaton of TNT.

Following an extensive test programme, the weapon was put into production as the B43 in 1960, the Mod 0 entering service in 1961, the Mod 1 following a year later. Cleared for internal or external carriage on the Boeing B-52, Vickers Valiant, English Electric Canberra, Douglas A-4 Skyhawk, Grumman A-6 Intruder and others, the B43 was progressively updated, and training versions (BDU-6, BDU-8, BDU-18 and BDU-24) were developed.

Production of the B43 ended in 1965, after completion of some 2,000 examples. It remained on the inventory, however, until its retirement in the 1980s in favour of the newer B61 and B83 weapons.

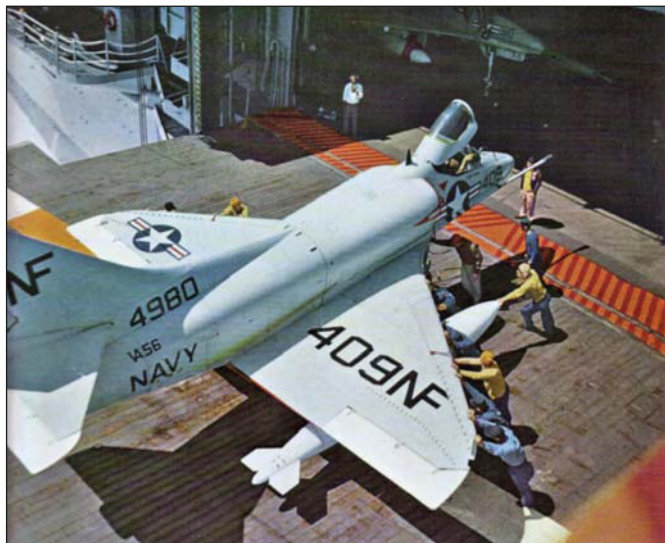
who was "hitching a lift" up on the elevator, saw that Webster's attention was focused in the cockpit, but could not tell if he was pumping the brakes. The two chock men threw the chocks behind the wheels, but the starboard chock landed just after the port and the A-4's starboard wheel slid. The port chock was knocked aside. The mainwheels reached the elevator edge and rolled over, damaging part of the safety net. As the Skyhawk tipped back on its stalky undercarriage, Webster appeared to try and stand up, but his harness held him back. He put his hands on the windscreen arch, but the canopy slammed down on his fingers. Witnesses recall a look of terror on his face as the aircraft continued its backflip and fell inverted into the water with a huge splash. "It was so quick," says Wilson, "it happened in the blink of an eye". The A-4 went under before the fantail had passed it and began its long journey to the seabed, 2,700 fathoms (16,000ft — 4,877m) below.

A khaki-dressed officer or chief of W Division ran over to the edge. "Was there a weapon on that 'plane?" he asked Pizzarella, which seemed an odd question to ask, given his responsibilities. "There was a ****ing pilot on that 'plane!" retorted Pizzarella, and stormed off.

BY THE BOOK?

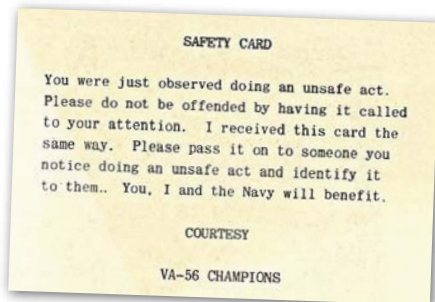
As the "man overboard" call repeated over the loudspeakers, W Division prepared a "Rainbow Message" — a pro-forma signal of the highest priority informing the White House, Pentagon and Seventh Fleet that a "Broken Arrow" had occurred. The *Tico's* commanding officer, Captain Robert N. Miller, a somewhat gung-ho type who was known to leave his executive officer in charge and fly missions over Vietnam in Douglas A-3 Skywarriors, looked at the message form and reportedly asked of nobody in particular: "Well, I guess we have to send this one?"

The carrier launched a helicopter and lifeboat



LEFT A VA-56 Skyhawk on the Tico's No 2 elevator, from which Webster and his A-4E fell. The elevator projected some 40ft (12.2m) from the carrier's port side, a yellow diagonal line being painted 18ft (5.5m) from the edge of the hangar deck, marking where the aircraft must come to a stop.

BELOW Safety aboard an aircraft carrier is paramount — this card aimed to keep crew aware of errors as discreetly as possible.



and, together with the escorting destroyers, conducted a search for about two hours, but all that was recovered were parts of a droptank and the pilot's helmet. By 1603hr the *Tico* was "steaming as before" towards Japan. Two of the destroyers stayed until sunset, but to no avail.

Captain Miller ordered the crew to stay silent about the accident. Outgoing mail was blocked. The VA-56 pilots knew that Doug Webster's new bride was in a hotel somewhere in Yokosuka, but not which one. The carrier docked on the morning of December 7 and Randy Wilson was near the officer's brow (gangplank) when he saw a group of officers talking to Mrs Webster. He saw her slump down and start crying before being led away.

The *Tico* returned to action on December 17. After seven more periods on the line, during which five more aircraft, including two VA-56

Skyhawks and pilots were lost on operations, the carrier finally "out-chopped" from theatre and headed back to San Diego on April 20, 1966.

A DELIBERATE COVER-UP?

The events of December 5 were kept from the public and press from the start. Seventh Fleet's monthly summary of operations for December 1965 does not mention the loss of an aircraft, pilot or bomb, although it does list all other losses and significant events. The VA-56 and *Ticonderoga* Command Histories held by the Naval Historical Center say nothing about it.

Naturally, there were several investigations into the accident. A version of the US Navy Judge Advocate General (JAG) inquiry has only recently been released, although it omits mention of the nuclear weapon. Doug Webster's personnel record

The Tico is accompanied by replenishment-at-sea (RAS) ship USS Mount Baker off the coast of California in September 1965, shortly before the carrier's departure for Hawaii and the Far East. One of the Skyhawks ranged on the forward and angled decks may well be "472".





ABOVE Skyhawk “401”, BuNo 150030, of VA-56 flies over the Sierra Nevada mountain range straddling California and Nevada, in 1964. The unit’s home port when not at sea was NAS Lemoore, California, the Champions having moved in when the base was opened in the summer of 1961 — before that the unit’s land base was NAS Miramar.

remains sealed. A two-paragraph summary of an initial investigation, eventually released under the Freedom of Information Act, reported that the accident was caused either by Lt (jg) Webster’s failure to respond to the director’s signal to apply brakes or that the aircraft suffered complete failure of the braking system. No evidence of malfeasance or gross negligence on the part of the handling crew or other naval personnel was found.

Ticonderoga sailor James Weber, who has done a great deal to uncover much of the source material for this article, believes that sabotage may have been involved. There were numerous fires and incidents on the cruise and two sailors later convicted of sabotaging aircraft were sent to Leavenworth military prison. On the morning of November 22 Weber saw a damaged B43 on a bomb elevator on one of the mess decks. Damaging a nuclear weapon, even accidentally, would be a career-threatening event for anyone even remotely involved, including the captain. Weber was subsequently twice ordered to the sick bay and asked about what he saw and how he was feeling. Although he believes that the bomb he saw is the one that went overboard, he has been unable to prove or disprove his suspicions.

Tensions between VA-56’s CO, who was a Naval Academy graduate, and NAVCAD Doug Webster have been alleged. It seems highly unlikely, however, that a conspiracy to “dispose” of a problematic weapon and pilot took place.

The secret was kept until 1981, when the accident appeared as the shortest entry in an official Department of Defense list of nuclear weapons accidents released under a Freedom of Information Act request. The full text read:

“December 5, 1965 / A-4 / at sea / Pacific. An A-4 aircraft with one nuclear weapon rolled off the elevator of a US aircraft carrier and fell into the sea. The pilot, aircraft and weapon were lost. The incident occurred more than 500 miles from land.”

Most observers understood the last part to mean 500 miles from mainland China, but in reality it was a mere 89 miles from the populated Japanese island of Kikaishima in the northern Ryuku Islands, and only 239 miles from the southern tip of Kyushu, Japan’s southernmost home island.

In May 1989 Greenpeace revealed details of the *Tico*’s deck log, causing outrage in Japan and a severe embarrassment for the American government. The text of the log read:

“1450 [hr]. While being rolled from No 2 Hangar Bay to No 2 Elevator, A-4E aircraft BuNo 151022 of VA-56, with pilot LTJG D.M. Webster USN 666086 aboard, rolled off the elevator and sank in 2,700 fathoms of water at 27° 35.2’N, 131° 19.3’E”.

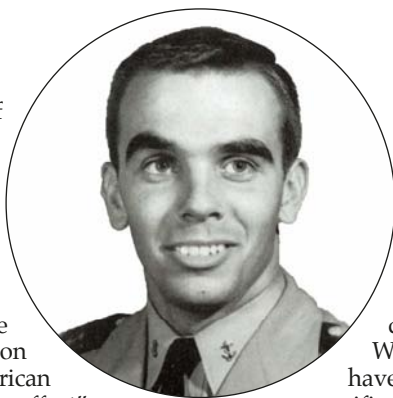
THE FATE OF THE BOMB

The Japanese constitution prohibits the “introduction” of nuclear weapons into its territory, but a secret understanding agreed during negotiations

for the signing of the Treaty of Mutual Cooperation between the USA and Japan in January 1960 exempted American military vessels from inspection. Following public protests, Japan demanded extra information but dropped the demand after meetings in December 1989 on the grounds that further discussion might "compromise" American operations and create an "adverse effect" on American national security interests.

As for the bomb itself, the Pentagon said in 1989 that: "Structural failure [of the weapon] occurred before it reached the ocean floor at 16,000ft, exposing nuclear material to the hydrosphere". The report concluded that "the high explosives contained in the bomb, which initiate a nuclear explosion, would have been corroded by sea water" and that "the nuclear material itself would dissolve in a relatively short time". It was so dense that "... it probably settled quickly on the ocean floor, and mixed with other sediment".

Douglas Webster's mother Margaret reportedly learnt the details of her son's death in early 1966 from a taxi driver, rather than through official channels. Many years later she visited Washington



DC and was distressed not to find his name on the Vietnam Veterans Memorial Wall. The official position is that his death was outside Vietnamese waters and not a combat operation, so does not qualify.

Since the basic details of his death became public, some of Webster's shipmates and friends have worked to have his service and sacrifice formally recognised and lift the veil of secrecy that fell over the incident as soon as his A-4 disappeared beneath the sea.

In 2006 Webster's friends succeeded in having his name added to a memorial book kept at the Wall site. Nearly five decades later many questions remain unanswered. Doug Webster's squadron mate Randy Wilson says today: "I believe something funny went on out there". We may never know precisely what.



ACKNOWLEDGMENTS The author wishes to thank Randy Wilson, George Floyd and other members of VA-56 and the crew of the USS Ticonderoga, and also Dennis Palmer. The Aviation Historian would like to thank Chika Falconer and Peter B. Mersky for their invaluable help with the preparation of this feature

"DOUGLAS WEBSTER'S MOTHER MARGARET LEARNT THE DETAILS OF HER SON'S DEATH IN 1966 FROM A TAXI DRIVER, RATHER THAN THROUGH OFFICIAL CHANNELS"

TOP Douglas Webster, whose gravestone resides at Arlington National Cemetery in Virginia. **BELOW** A view from the bridge of the Tico of the USS Constellation beyond the Skyhawks of VA-56 at San Diego in 1966, after the Tico's return to home waters.

PETER B. MERSKY COLLECTION



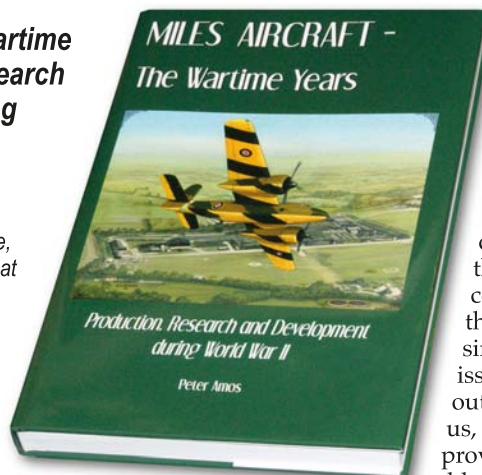


Armchair AVIATION

We take a look at what's available for the aviation history enthusiast in the world of books and other literature, from brand-new hot-off-the-press publications to reissued classics

Miles Aircraft — The Wartime Years. Production, Research and Development during World War II

By Peter Amos; Air-Britain, 41 Penshurst Road, Leigh, Tonbridge, Kent, TN11 8HL, available online at www.air-britain.co.uk/actbooks/acatalog/; 8½in x 12in (216 x 305mm); hardback; 432 pages plus CD of appendices, illustrated; £34.95 to Air-Britain members, £47.50 to non-members. ISBN 978-085130-430-4



THE FIRST VOLUME of this long-awaited and ambitious three-part company history, something no commercial publisher would have undertaken, appeared in 2009. This second volume covers the Miles Company's Second World War products, both real and imaginary, and while readers will doubtless be pleased to have the histories of the Magister and Master brought to completion, with descriptions of various adaptations, and to be able to read very complete accounts of some of the more obscure wartime products, including the M.33 Monitor target tug, M.20 fighter and M.35 and M.39 Libellulas, they can also indulge themselves with an extraordinary range of projects. Among these are the extensive "X" series of transports with aerofoil-section fuselages blending into their wings, other Libellula-style designs for a variety of roles, the pilotless Hoopla radio-controlled bomb-carrier and various transport aircraft.

A bonus with this volume is a CD of appendices containing comprehensive individual histories of every Magister, Master, Martinet, Monitor and Messenger Mk I built during 1939–45, plus details of additional company activities and background information. This may also be bought as a 400-page softback hard-copy publication for another £19.50 including p&p,

but only with the main volume; not separately.

One cannot help thinking that the Miles design team was sometimes rather over-ambitious in its schemes, and that many of the projects were fated from the outset to remain on paper. On the other hand, they had the courage to dream and stretch their imaginations, rather than simply respond to specifications issued by officialdom, and their output was truly impressive. For us, this adventurous approach provides some fascinating reading, ably assisted by a bountiful supply of data, period artists' impressions

and brochure-type illustrations. Miles might have been a small company, but it had big ideas. They culminated in the M.52, which, had it not been cancelled, might have become the world's first supersonic jet aeroplane. That story begins in the final pages of this volume, but we shall have to wait for Volume 3 to read the dénouement of this hotly-debated subject. I suspect it will be worth waiting for.

PHILIP JARRETT

Mersulaivue — Lentolaivue 34 sodassa

By Kari Stenman; Kari Stenman Publishing, Maininkitie 14A, 02320 Espoo, Finland. Available from The Aviation Bookshop, 31–33 Vale Road, Royal Tunbridge Wells, Kent TN11 1BS (www.aviation-bookshop.com); 8½in x 12in (216mm x 305mm); hardback; 168 pages, illustrated; £39.99 from The Aviation Bookshop. ISBN 978-9-52997-437-5

DECEMBER 12, 1942, was a significant date for the fighter arm of the Finnish Air Force (FAF) at war. On that date lengthy efforts to obtain up-to-date fighters from Germany bore fruit as Finns learnt that *Reichsmarschall* Hermann

Goering had given his blessing for the selling of Messerschmitt Bf 109s to Finland. This led to a contract stipulating that Germany would sell 16 new and 14 factory-overhauled Bf 109G-2s, plus replacements for combat losses, to Finland. On January 23, 1943, a new fighter squadron, *Lentolaivue* (Squadron) 34 (subordinated to *Lentorykmentti* 3) was established under the command of Major Olavi Ehrnrooth. As the intention was to create an elite unit, Ehrnrooth was given a free hand by the FAF commander, Lt Gen Jarl Lundqvist, to pick the pilots he wished. So began a 17-month combat stint during which the squadron claimed 345 victories while losing 18 aircraft in combat and another 11 in accidents.

Kari Stenman is certainly a familiar name to anyone with more than a passing interest in the wartime history of the Finnish Air Force. This latest book is in the typical "Stenman style", the text being a solidly-researched chronological account of the unit's operational history interspersed with combat reports and lengthy excerpts from previously-published memoirs. The appendices provide listings of pilots, losses, claims, aircraft, bases and personnel.

The book includes plenty of high-quality photographs, most of which have been obtained from the official Finnish Army archives. Coupled with excellent repro, this means none of the fuzzy semi-unrecognisable "private" photographs some publishers tend to use. Many of the photographs are reproduced full-page and there are also eight pages of colour profiles by Pentti Manninen and Thierry Dekker.

Although the book is entirely in Finnish (and it is important to note that there are NO English captions), non-Finnish readers may still obtain a great deal of information with a very limited Finnish vocabulary, as the appendices and captions are clearly and succinctly written.

On face value, this book is an excellent combat chronicle, but as a comprehensive unit history it is less useful. The author does not analyse any data he presents; for example, the validity of individual pilot claims is not discussed in any depth. He does not cover non-combat events at all and subjects like fighting spirit, disciplinary issues and



personal rivalries are also set aside. There is a feeling that the author is reluctant to venture into anything that might diminish the gloss official propaganda has created over the years.

Some *TAH* readers may have acquired Stenman's bilingual six-volume treatment of the FAF from 1918 until 1945. I have not compared how much of the photographic material in that publication overlaps with this book,

but textwise there is considerable overlap.

In summary, those seeking a high-quality lavishly-illustrated combat chronicle of one of the finest fighter squadrons of the Second World War should consider adding this to their collection.

JUKKA JUUTINEN

Battle Flight: RAF Air Defence Projects and Weapons Since 1945

By Chris Gibson; Hikoki Publications, Crécy Publishing Ltd, 1a Ringway Trading Estate, Shadowmoss Road, Manchester M22 5LH; 8½in x 12in (216mm x 305mm); hardback; 208 pages, illustrated; £29.95; ISBN 978-1-90210-9268

THE ADVENT OF the jet engine during World War Two meant that it would be necessary to detect and intercept aircraft of much higher performance than ever before. The threat had also changed to emanate from the Soviet Union, and to include both high- and low-level attacks.

Using recently released material, Chris Gibson describes the many British projects developed to meet this threat, skilfully weaving his way through the Ministry of Supply "Rainbow"

system of codenames, including such gems as *Green Mace* (anti-aircraft gun), *Orange Poodle* (radar) and the aptly-named *Blue Joker*, a long-range radar system hauled aloft by two barrage balloons to improve the radar horizon, but which could not be deployed in high winds. There are details of many projects, including interceptors, radar systems, "force multipliers", "flying battleships", tankers and missiles.

The "dead years" of 1946–51 and the "muddle years" post-1957, along with the need after both periods to catch up with developments,



especially those in the USA, are covered in detail and accompanied by a number of trenchant observations, such as the comment made by an RAF officer on his return from a research trip to the other side of “the Pond” that an anti-ballistic-missile system being developed in Britain belonged “to the piston era”. Upon the system being duly cancelled on the grounds of cost, the Ministry of Supply and the Air Ministry are then depicted as “looking in the parts bin for a cheaper solution”.

The author’s in-depth approach includes details of various reports and changes of policy, such as the Air Ministry’s working party report of 1954 which recommended a switch to surface-to-air missiles, thus paving the way for the infamous 1957 Sandys White Paper. However, this was followed in 1964 by another much less well-known working party led by the redoubtable R.V. Jones, and which, uncluttered by outstanding projects, was able to start with a clean sheet. This would go on to define air defence policy for the next 40 years and foresee the advent of the multi-role combat aircraft. The procurement history of the Panavia Tornado F.3 is chronicled, and of particular interest is the tension between those serving officers who wanted the American Grumman F-14 or McDonnell Douglas F-15 and the arguably more pragmatic politicians anxious to preserve design and manufacturing capacity at home.

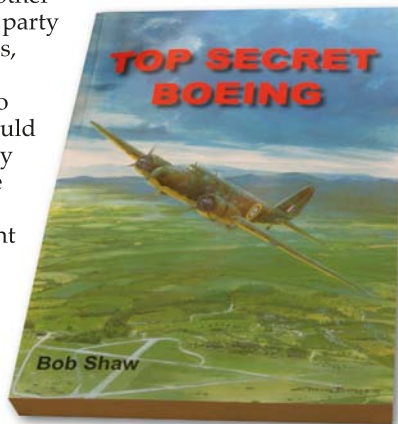
This book is a *tour de force*, containing a plethora of information, as well as being eminently readable and well illustrated. No self-respecting aviation historian interested in the post-World War Two period should be without it.

FRED CROSSKEY

Top Secret Boeing

By Bob Shaw; published by the author on behalf of the Defford Airfield Heritage Group. Available from www.deffordairfieldheritagegroup.wordpress.com; 5¼in x 8¼in (146mm x 210mm); softback; 214 pages, illustrated; £11.95; ISBN 978-0-954704-51-3

THIS IS UNUSUAL in being not a monograph on one aircraft type, but on one specific aeroplane. It might be thought that this would limit sales, but following initial publication in March 2012 the book sold out and a reprint was issued last year.



The Boeing 247 airliner lost out to the Douglas DC-3, but one of them, 247D NC13344, had an extraordinary career and amassed an estimated flying life of at least 11,000 hours. Its conventional time as an airliner on America’s domestic routes was spent with National Air Transport/United Air Lines, Pennsylvania Airlines and Pennsylvania-Central Airlines. Having narrowly escaped sale to Spain in a shady arms deal in 1937, it then served with Wyoming Air Service and Inland Air Lines until it was sold to a new owner in Canada as CF-BTA and became 7655 in the Royal Canadian Air Force. In 1941, as a flying demonstrator for the American AI-10 air interception radar, it came to Britain and was taken on to the British military inventory as DZ203. During secret radar trials at Defford

Airfield, Worcestershire, the Boeing proved ideal in the eyes of both the radar scientists and the airmen who flew it, and went on to make the first airborne trials of X-band radar under tight security during 1942–43.

The Boeing was then rebuilt and fitted with new radar, and in January 1945 made the world’s first automatic orbit, approach and blind landing, and then continued with this work for two more years. It ended its life with the Blind Landing Experimental Unit, being struck off charge at the

end of 1946, damaged in a storm and scrapped.

This very complete history covers the aeroplane itself in minute detail, the technicalities of the work it undertook at Defford, and the development of the various Allied wartime radars. The author has supported his text with an ample supply of good images depicting the aircraft, both externally and internally, and the associated equipment it carried. Moreover, an introductory chapter provides an outline history of the type, and references and an index are provided. This is excellent value for money, but specialised stuff.

PHILIP JARRETT

Junkers F 13: The World’s First All-metal Airliner

By Lennart Anderson, Günter Endres, Rob J.M. Mulder and Günther Ott; EAM Books EEIG; 3 Gatesmead, Haywards Heath, Sussex RH16 1SN; 8¼in x 11¼in (222mm x

286mm); hardback; 288 pages, illustrated; £39.95; postage to UK £6, to Europe £12, RoW £20; ISBN 978-0-95737-440-9

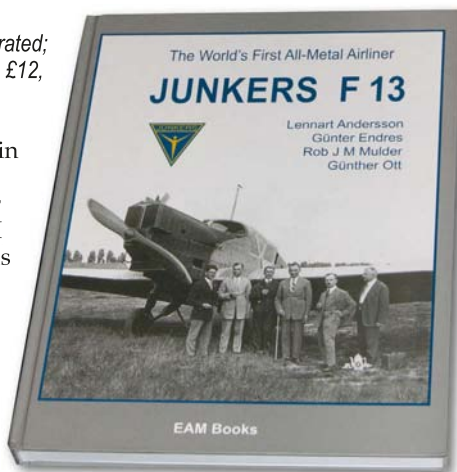
IF YOU HAVE only one book in your collection on this classic pioneering corrugated airliner (which is more than likely, as I cannot think of another), this is the one you should have. This weighty monograph, profusely illustrated with monochrome photographs depicting the F 13 serving worldwide in both civil and military roles as a landplane on wheels and skis and as a seaplane, covers every aspect of the type's history, from its genesis to museum survivors. It includes tabulated individual histories, four pages of full-colour side elevations offering a good assortment of schemes, and even colour pages of relevant postage stamps and ephemera.

Research for this book revealed that 348 F 13s were built, rather than the figure of 322 often quoted hitherto. The complete production listing, which includes all changes of ownership for each machine, takes just over 56 pages, and a listing of worldwide distribution shows that F 13s served with more than 150 operators in 44 countries across the six continents. The picture gallery includes an exceptional number of rare pictures, all well-reproduced on the matt paper.

Personally, I feel that more attention should have been devoted to the fatal crash of G-AAZK of Walcot Air Line on July 21, 1930, as to the best of my knowledge it was the first proven case of metal fatigue causing a fatal accident, and was the subject of a lengthy official investigation and analysis. However, bearing in mind the amount of material the authors had to juggle and fit in, this might be considered selfish.

Useful airline fleet lists are provided, and every sort of usage is included, including clandestine activities and special modifications such as the American Junkers Larsen JL-12 attack aircraft with its 30 Thompson machine-guns, and the weird appendages attached to D226 to assess the functioning of the tail unit of the giant G 38.

This is not a cheap book, especially if you are having it posted to you outside the UK, but one should expect



to pay for quality, and it is here in heaps. An index would have been useful.

PHILIP JARRETT

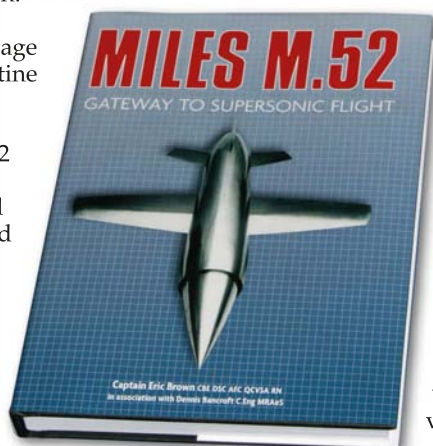
Miles M.52: Gateway to Supersonic Flight

By Capt Eric Brown; Spellmount, The Mill, Brimscombe Port, Stroud, Glos GL5 2QG; 6¾in x 9in (171mm x 229mm); hardback; 222 pages, illustrated; £18.99; ISBN 978-0-75247-014-6

THIS REVIEWER HAS always had great admiration and respect for test pilots, and none more so than "Winkle" Brown. However, expertise in one sphere does not make one an authority in another. Test flying and history are both demanding disciplines, but experience has taught me that test pilots do not necessarily make good historians. This book has aroused a degree of contention and annoyance among some authorities and aficionados of the Miles Aircraft Company and its products, even though their assistance is acknowledged in the front of the book. Apart from their resentment that their requested comments and corrections regarding the original text were ignored, one of their principal criticisms is the author's alleged tendency to present unsubstantiated claims as fact. It is always upsetting when such disputes become acrimonious, but when people take history seriously or feel they have been ill-served, emotions will inevitably come into play.

Anyway, the M.52 always gives rise to argument. Could it have been the world's first supersonic jet? Why was it cancelled? Was a team

of visitors from the USA given vital information? How close to completion was the M.52 at the time of the cancellation? Readers who think they will find conclusive answers in these pages should perhaps wait until Volume 3 of the Air-Britain books on Miles Aircraft appears, and then make some comparisons. Sometimes we need to know when we are being led to believe that something is a fact when it is not. For example, the "Gillette Falcon" did not have a variable-incidence wing, and



there was no “official” connection between Spitfire IX PV290 and the M.52; its large tailplane was fitted for comparative gun-platform trials with a standard Mk IX, and its subsequent testing by Aero Flight was an unexpected spin-off benefit.

Although Dennis Bancroft’s portrait appears on the first page of Chapter 3, it is far from clear that he actually wrote this chapter.

In general the picture research has been good, and for such an obscure and secretive project an impressive quantity of illustrations is provided, including related aircraft and projects, and relevant personnel. However, there is an evident inability to differentiate between the English Electric Lightning and its P.1 prototypes. It is very easy to say, as the author does, that the cancellation of the M.52 “. . . lost Britain the undoubted world lead in the supersonic field”, but that is begging the question. We can never know just how good (or bad) the M.52 proper might have been; we can only speculate, and that is not history.

PHILIP JARRETT

US Marine Corps F-4 Phantom II Units of the Vietnam War

By Peter E. Davies; Osprey Publishing, Midland House, West Way, Botley, Oxford OX2 0PH; 7½in x 9½in (190mm x 241mm); softback; 96 pages, illustrated; £13.99; ISBN 978-1-84908-751-3

THIS STORY HAS been a long time coming, and what better publisher or author to tell it? Several books on US Marine Corps (USMC) Phantoms have appeared over the years but none with this amount of depth and detail, not to mention one of the most stunning covers in the entire Osprey catalogue. Scottish digital artist Gareth Hector has created a remarkable depiction of the F-4 in action, in which the Phantom fairly roars off the cover. And as always, Jim Laurier has produced his usual folio of superb colour profiles showing various USMC squadron markings as well as the armament and ordnance carried by “Leather-neck” Phantoms in South-east Asia.

The author was helped by the participation of several now-senior Marine aviators who flew multiple tours during the Vietnam War and who well recall their experiences and the people they flew with. The book begins with a brief history of



the Phantom II, before moving on to a description of early missions for USMC F-4s in Vietnam, starting in 1965 under the auspices of the iconic Maj Gen Keith McCutcheon, this section being one of the most detailed such discussions I have yet read.

Historians often devote most of their coverage to the stories and experiences of crew, but the author takes time here to set the scene and write about the delivery techniques

and co-ordination that made the USMC Phantoms so important so early in the war.

A dozen USMC squadrons flew the Phantom in Vietnam, and this book describes each unit’s experiences, often involving many tours during the conflict. The more well-known squadrons, VMFA-115 and VMFA-232 for example, share space with lesser-known units such as VMFA-314, VMFA-334 and VMFA-122. Being less well known certainly doesn’t mean these squadrons had less than their share of action. Far from it! Marine Phantom squadrons lost quite a few aircraft and crewmen, several of whom ended up as PoWs.

The Marines were great developers of weapons, one unit loading up its aircraft with no less than three gun pods to augment the aircraft’s prodigious bomb and rocket loads. Orbiting over the battlefield, Phantoms were often the answer to a harried forward air controller’s prayers and when the situation was right, the grey battered F-4s from Da Nang and Chu Lai could mean the difference between victory and defeat when “mud Marines” were engaging the enemy.

Also included in this volume is perhaps the most detailed account of the photo-Phantom’s special war. The RF-4B was one of the few truly dedicated reconnaissance platforms flown in Vietnam. The Vought RF-8A/G Crusaders of the US Navy and USMC, along with the Navy’s North American RA-5C Vigilantes and Douglas RA-3B Skywarriors, not forgetting the USAF’s RF-4C and the McDonnell RF-101A/C Voodoos, were all high-performers throughout the conflict. The RF-4B, which was only flown by the USMC, was a very special type, and could do almost anything that was asked of it in the area of gathering photographic, infrared and electronic imagery intelligence. Yet little has been written about the RF-4B, and this element offers a valuable window into this rarely-covered world. This latest addition to Osprey’s *Combat Aircraft* series (No 94) is arguably one of the best.

PETER B. MERSKY



Lost & Found




ABOVE Four businessmen in front of a spray-equipped Pitcairn Autogiro — can any readers identify them?



ABOVE An anonymous trio beside New Standard D-27A NR2539 in the 1930s; is one of them Fred “Slim” Soule?

PHILIP JARRETT explores the lesser-known corners of aviation history, discovering unknown images and rediscovering long-lost details of aircraft, people and events. This time some found photographs have lost their identities. Can you fill in the blanks?

AS THESE THREE photographs came together they are probably related, but there were no helpful clues on their backs, and none of the men is identified. The evident common connection is crop-spraying in the USA in the 1930s. The biplane (main picture, **BELOW**) is New Standard D-27A NR2539, powered by a seven-cylinder 225 h.p. Wright J6 Whirlwind radial engine and fitted with a spray device well shown in the three-quarter-rear view.

The four hatted and coated gentlemen are posed in front of a Pitcairn PCA-2 Autogiro which has a spray device beneath its fuselage, and one of these aircraft was used for aerial application by Fred W. “Slim” Soule, who reportedly “found it much superior to any fixed-wing airplane of that time”. Soule, who might be one of the trio in front of the D-27A, later became a Pitcairn test pilot. If any readers have any further information regarding the aircraft, people or occasions, it would be most welcome; please contact the Editor. 



mercury rising



*In his new book **Spacesuit: A History through Fact and Fiction**, space medicine specialist **BRETT GOODEN** traces the evolution of the clothing developed to enable mankind to survive the most hostile environment it would ever encounter. Here he describes the (frequently man-made) challenges facing NASA's Project Mercury*

DRAMATICALLY, on October 4, 1957, the world's first man-made Earth satellite was shot into orbit by Soviet Russia, thus heralding the birth of the "Space Age". In the USA this spectacular — and for the Americans, demoralising — Soviet achievement brought about a decisive change in its thinking about space exploration, in particular the need for a serious concerted effort to achieve manned space flight.

Within 12 months the National Advisory Committee for Aeronautics (NACA) had become the National Aeronautics & Space Administration (NASA) and its first Administrator, T. Keith Glennan, had committed NASA to the development of the USA's first manned space flight programme. On November 26, 1958, Glennan and Deputy Director Hugh L. Dryden named the manned satellite enterprise "Mercury".

Developing the spacesuit

In 1947 the US Air Force and Navy agreed to specialise in developing partial-pressure and full-pressure flying suits respectively. The line was distinctly blurred, however, and the rivalry to perfect a full-pressure suit became more intense than ever. None of the suits developed so far was satisfactory for the extreme altitude protection required by the Mercury astronauts.

The right stuff — the astronauts selected for NASA's Mercury space programme, known as the Mercury 7 or Original 7, were presented to the press on April 9, 1959. They were: front row, from left to right: Walter H. "Wally" Schirra Jr; Donald K. "Deke" Slayton; John H. Glenn Jr; Scott Carpenter. Back row, from left to right: Alan B. Shepard Jr, Virgil I. "Gus" Grissom and L. Gordon Cooper.

ALL PHOTOGRAPHS VIA NASA



OPPOSITE PAGE John Glenn blasts skyward in Friendship 7 on the Mercury-Atlas 6 mission on February 20, 1962, to become the first American to orbit the Earth. Glenn circled the globe three times in a flight lasting 4hr 55min.



ABOVE A Mercury suit is subjected to a pressure of 3.5lb/in², close to the minimum required for human survival if the capsule lost its oxygen atmosphere. Even at this relatively low pressure the man in the suit is virtually immobilised — more work was needed. **BELOW** John Glenn has his right glove fitted to the suit forearm via a fully rotatable ballbearing lock.



Through the spring of 1959 three firms competed to provide that suit: the David Clark Company, the Playtex division of the International Latex Corporation of Dover, Delaware (the division that produced women's girdles and babies' milk bottles) and the B.F. Goodrich Company.

The Air Force Aeromedical Laboratory at Wright Air Development Center and the Navy Air Crew Equipment Laboratory in Philadelphia evaluated the suits. Predictably, the USAF favoured the Clark suit and the Navy the Goodrich suit. In the event, Goodrich was awarded the prime contract for the Mercury spacesuit on July 22, 1959.

One of the most senior employees at the Goodrich Company was Russ Colley, who had been instrumental in the creation in the mid-1930s of an early pressure suit for record-setting aviator Wiley Post, who wanted to fly to altitudes of around 28,000ft (8,500m) in his Lockheed Vega *Winnie Mae*. In 1959 Colley, along with his colleagues at Goodrich, modified the Navy Mark IV pressure suit for orbital flight. Late the previous year the USAF had authorised production of the Navy Mark IV full pressure suit for its squadrons stationed in colder areas of the USA.

The suit weighed 9kg (20lb) and consisted of a one-piece garment plus helmet, gloves and boots. A pressure-sealing zipper cut diagonally across the chest section. It provided greater mobility when in the unpressurised state in the shoulders, legs and arms because of the Helanca stretch-knit fabric tailored into the construction of the inner layer in those areas of the suit.

Structure of the Mercury spacesuit

There were three major components to the Mercury spacesuit — torso, helmet and gloves. The torso was specially tailored for each of the seven astronauts, and was of two-layered construction incorporating an inner gas-retaining bladder of neoprene and neoprene-coated nylon fabric and an outer layer of heat-reflective aluminised nylon fabric. Straps attached to the neck and torso held a cable which would keep the helmet in position in relation to the torso if the suit was pressurised and the suit ballooned.

Donning and doffing the suit was via a pressure-sealing zipper, which extended diagonally across the front of the torso from the left shoulder down to the waist. Ventilation was provided by a system of tubes on the inside of the suit that led to the body extremities. These tubes were constructed from a helical spring covered by a neoprene-coated nylon fabric that contained perforations at regular intervals to distribute the pure oxygen.

The helmet comprised a hard, resin-impregnated glassfibre shell with individually moulded crushable impact liner, a ventilation exhaust outlet, a

visor-sealing system and communications system. Poor mobility in wrist action during the first manned Mercury flight — Alan B. Shepard Jr's brief suborbital mission on May 5, 1961 — required attention. From Virgil I. "Gus" Grissom's suborbital flight on July 21, 1961 onwards, the gloves were attached to the suit torso at the lower forearm by nylon-sealed ballbearing ring locks.

The gloves, like the torso, were of two-ply construction. The inner gas-retaining layer was fabricated by dipping a mould of the astronaut's hand into a liquid rubber compound. Lacing were provided on the back of the gloves for minor adjustments. When pressurised, the gloves' fingers assumed the same contour as the control stick which could operate the three-axis spacecraft attitude-control system. Two restraint straps at the wrist were provided to form break lines to improve mobility of the glove during pressurisation. A miniature red light was attached near the tips of the index and middle fingers to allow instrument panel and chart illumination and was powered by a battery pack and switch on the back of the gloves. Lightweight aluminised nylon fabric boots were specially designed for the Mercury pressure suit.

Next to their skin the astronauts wore a one-piece lightweight cotton undergarment with long sleeves and legs. Ventilation spacer patches were incorporated on the outside of this undergarment to ensure that ventilating gas flowed over certain critical areas of the body.

Plugging in

A pressure suit environmental control system in the body of the spacecraft provided breathing oxygen, maintained suit pressurisation, removed metabolic products — namely carbon dioxide, water vapour and odours — and maintained the gas temperature. A cabin-pressure regulator metered pure oxygen into the cabin to maintain the lower limit of pressurisation of 35 per cent of one atmosphere (5.1lb/in²).

Engineering tests showed that the heat load inside the capsule during re-entry from space would not be as great as expected, which allowed the pressure suit developers to remove much of the insulation previously thought necessary. Pressurisation of the prototype suits was found to stretch the suits out of shape. A variety of new textiles had to be tested until the problem was solved. A multitude of minor problems with zippers, the visor, the segmented shoulder, lacing, straps, snaps, seams, valves, underwear, gloves, microphones and neck dams continued until a "gripe session" was held in mid-May 1960. At this definitive meeting, the astronauts and their tailors essentially agreed on what the well-dressed man would wear in space.



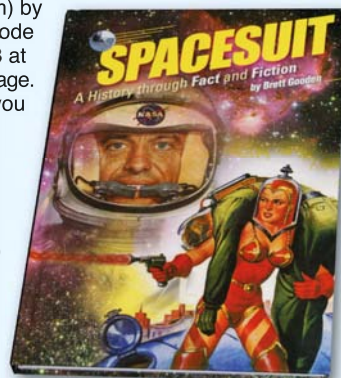
ABOVE Alan B. Shepard, the first Mercury astronaut to fly a suborbital mission into space, in May 1961, demonstrates the helmet and upper torso of the Mercury pressure suit. A cable and strapping held the helmet in position if the suit was pressurised. A pulley within the cable-tethering point on the chest allowed the cable to slide through it as the helmet was turned.

Exclusive TAH reader offer for *Spacesuit* by Brett Gooden

WANT TO KNOW more? *Spacesuit: A History Through Fact And Fiction* (ISBN 978-0-9543115-4-4) is published by Tattered Flag Press (www.thetatteredflag.com). Readers of *The Aviation Historian* may obtain a copy of this splendid book (RRP £16.99/US\$27.95) with a **20 per cent discount** off the RRP via Casemate UK (£13.59 from www.casematepublishing.co.uk) and Casemate USA (US\$22.36 from www.casematepublishing.com) by simply using code **SPACETAH13** at the checkout page. Alternatively, you can quote the code when ordering by telephone:

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AUTHOR'S PHOTOGRAPHS

Off the beaten track...

*Ever turned a corner to find something completely unexpected? The Aviation Historian's intrepid aeronautical explorer **PETER DAVISON** investigates the stories behind the oddities that turn up in the most unusual places*

PROBABLY THE ONLY Ilyushin Il-28 *Beagle* in the southern hemisphere, this Il-28T has reappeared relatively recently on a roundabout just south of Surabaya International Airport at the eastern end of the island of Java, Indonesia. There had been rumours of its survival for many years.

It is thought that "510" was the last of ten torpedo-capable versions with a lengthened bomb bay delivered to the Indonesian Navy with two Il-28U trainers. They saw service during 1965–67 in the minelaying and conventional bomber roles. The type first flew in 1950 and was widely used in the Soviet Bloc in a similar role to the RAF's Canberra. A Chinese-built variant, the Harbin H-5, still serves in the People's Republic.

I can find no record of an Il-28 ever visiting the UK. One nearly made it in July 2001 when a restored Romanian Air Force example, "310", was scheduled to appear at the Royal International Air Tattoo at RAF Cottesmore. Following a runway accident only days before, the visit was cancelled, and with it the last opportunity to see a flying example in the UK.



ABOVE Ilyushin Il-28 "510", formerly of the Dinas Penerbangan Angkatan Laut (Indonesian Naval Aviation Service), and now firmly anchored to a traffic roundabout near Surabaya airport in Java, was photographed by the author on December 13, 2009.

BELOW Romanian Air Force Harbin H-5 "310" in open storage at Bacau Air Base in Romania, in August 1998. It was this aircraft that was due to appear at RIAT in 2001, but a runway accident on July 21 of that year, just a few days before the show, meant it was not to be.





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